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PREFACE

This index, though arranged alphabetically, retains the grouping of the subjects used in the *Monthly Bulletin*. The arrangement of the subjects in each group is in chronological order of publication, except in the case of those relating to Agricultural Development, where the alphabetical arrangement was considered more useful.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *Monthly Bulletin*.

The index consists of three parts : one, of the original articles, one concerned only with Agricultural Intelligence and the last with Plant Diseases.

This volume of contents has been prepared by the redacteur Dr. Giulio Provenzal.

THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

ORIGINAL ARTICLES

Fruits and Nuts grown under Extensive Culture in Spain [1]

by

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The chief fruits and nuts grown under extensive culture in Spain are as follows : fig (*Ficus carica*), chestnut (*Castanea vesca*), walnut (*Juglans regia*), hazelnut (*Corylus avellana*), almond (*Amygdalus vulgaris*), carob (*Ceratonia siliqua*), pomegranate (*Punica granatum*). These trees agree in being grown in uniform plantations on unirrigated land ; they receive little or no manure and require very little attention in the way of pruning, etc. Further, they have the advantage of allowing of the utilization of irregular sloping land of medium quality, which is very frequent in the Iberian Peninsula, so that their cultivation has extended greatly and will go on extending. The total area at present planted is 957 920 acres, yielding a gross return of £6 085 928 ($29 617 167).

Table I shows the distribution of the plantations, according to the latest official statistics ; Table II gives an idea of the importance of the export trade in the produce of these crops.

Several of the trees here treated are, or can be, grown in every province in Spain, while others are restricted to definite regions. Among the former come fig, chestnut, walnut and hazel, which are not very particular as to climate ; the remainder are restricted to the warmer parts, particularly the Mediterranean basin.

Fig. — The fig is the most widely diffused of the trees of the first group. It is grown in every province, but as an industrial crop it assumes

(1) See also, by the same author: " The Present Condition of Citrus Growing in Spain ", *B.* Feb. 1913, pp. 162-167; and " Present State of Fruit Growing in Spain Principal Fruit Trees of the Rosaceae) ", *B.* July 1914, pp. 836-842. (*Ed.*).

TABLE I. — *Distribution of fruit plantations (in acres).*

Region	Almonds	Carobs	Figs	Pome-granates	Chest-nuts	Walnuts	Hazel-nuts	Total
Central	2 847	—	1 500	37	138	702	7	5 321
Meseta and Estremadura	628	—	4 206	282	4 480	361	—	9 956
Old Castile	356	—	336	2	1 026	3 937	106	5 763
Aragon and Rioja	33 217	—	2 409	—	—	4 470	10	40 107
Léon	608	—	148	—	6 672	1 416	—	8 844
Galicia and Asturias	—	—	2 135	—	82 605	1 080	6 529	92 349
Navarre and Vascongadas	618	—	247	—	25 025	1 386	45	27 321
Catalonia	35 263	58 072	3 114	138	2 454	736	36 042	101 223
East Coast	95 287	296 436	60 721	2 978	—	489	—	455 911
E. Andalusia	18 109	148	19 927	2 217	18 534	754	158	59 525
W. Andalusia	4 352	—	9 121	2 597	7 359	465	111	23 832
Balearic Is.	61 779	24 711	37 067	—	—	—	—	123 557
Canaries	3 460	—	507	124	210	—	—	4 300
	—	—	—	—	—	—	—	957 919

TABLE II. — *Export trade in nuts and fruits.*

Kind of fruit	Value of exports (pesetas)				
	1909	1910	1911	1912	1913
Unshelled almonds	4 470 031	3 039 758	4 273 775	3 212 837	4 801 603
Shelled almonds	21 712 596	16 328 065	21 923 333	12 771 298	22 952 971
Dried figs	705 935	2 144 309	1 552 956	1 239 528	1 375 215
Pomegranates	510 858	700 091	602 351	423 164	400 076
Chestnuts	610 888	848 714	925 980	602 218	774 319
Hazelnuts	7 242 626	5 450 519	7 452 346	10 372 779	4 842 740
Other dried fruit	286 866	318 801	330 376	381 212	349 196
Total pesetas	33 539 800	29 730 257	37 061 117	29 003 036	35 496 120
Total £ (at 25.20)	1 410 309	1 179 772	1 470 679	1 150 914	1 408 576
Total $ (at 5.18)	6 863 271	5 741 361	7 158 060	5 600 924	6 854 836

special importance in the southern and eastern part : here figs, fresh and dried, represent quite a considerable item of the people's food. The poorer

qualities are used for feeding live stock, while the best are exported. In Murcia the value of the crop reaches 4 million pesetas (£150 000, $770 000), while in Castellón it is estimated at 1 717 000 pes. (£68 500, $331 500). There are also very large plantations in the Balearic Islands, which resemble the provinces just mentioned in many respects ; in the plain of Majorca alone they suffice for the fattening of some 20 000 pigs for the French market, besides being largely used for human consumption. Among the regions of Andalusia, the first place for fig production is held by Malaga (£91 600, $445 700) ; it is followed by Almería, Granada and Huelva. A considerable portion of the " fig cake ", made from a pulp of figs, almonds, sesame and aniseed in the provinces of Murcia and Malaga, is exported. In the Estremaduran region the districts of Hervás and Jarandilla (prov. of Cáceres) should be noted, and in Aragon the provinces of Teruel, Saragossa and Huesca. The districts of Caspe, Maella, Fraga, Oso, Jardin, etc., in the plain of the Cinca, prepare excellent Albares figs, which make good prices on the home and foreign markets.

The fig is most useful for planting poor, stony and steeply sloping land ; safe crops are obtained at very little expense, the only danger being from autumn rains, which may spoil the fruit and make drying difficult.

A large number of varieties are known in Spain. In the East Coast region the best known are : Napolitana, Coll de Dama and Parotchal, with black fruit ; De la Vall, Peladores and Del Caviós, with white fruit. In Andalusia the following are grown : Isabeles, Albares, Cuello de Paloma, Pajareros, Napolitanos, Verdejos, Sultanes and Gabrieles ; in Aragon : Buyasot, Maella and Melar.

The fig is not much subject to the attacks of insects, the only one worth mentioning being the fig scale (*Ceroplastes rusci*).

Specialized industrial cultivation is unusual except in the Balearic Islands. In Majorca grain and pulse crops are usually grown below the trees. On the East Coast and in Andalusia figs are generally planted more or less thinly among vines or on market-garden land.

Walnut. — This tree is grown in only four provinces and is consequently less important in Spain than the fig. The largest numbers are found in the central and north-western provinces ; New Castile, Aragon, the central and northern part of Burgos and the provinces of Santander and Lugo are the chief centres of production. The total value of the walnut crop averages £173 400 ($843 700). A considerable quantity of nuts are exported from the provinces of Burgos and Logroño to South America.

Industrial plantations are infrequent ; the trees are almost always found isolated or in small groups among other fruit trees, or else in fields of grain or vegetables. Little attention is given to them, and they are almost all self-sown.

The varieties chiefly grown in Castile and Aragon are Comun, Rinconera and Pajarera ; in Léon, Comun and Mollar ; in Andalusia and the East Coast, the little Comun, Mollar and Fuerte (or Rinconera).

The crop is very regular ; almost the only danger is from spring frosts, which may damage the buds ; for this reason late varieties should

be chosen. The number of trees has diminished almost everywhere, as the high price of the wood induces felling.

Chestnut. — As far as temperature is concerned, the chestnut might be grown in almost all the provinces in Spain, but moisture conditions restrict its area. The zone of chestnut cultivation reaches along the west and north in the provinces on the Portuguese border : Galicia, Asturias, Vascongadas and Navarre. Another independent zone of some importance occurs in the province of Granada ; here, as elsewhere in the interior of the country, chestnuts occupy land at a certain elevation, characterised by greater humidity. Along the Cantabrican coast the required humidity is due to the nearness of the sea.

In the Cantabrican region chestnuts form one of the principal agricultural resources ; in the provinces of Lugo, Orense and Oviedo they even form the chief food of the people, and there is still sufficient for a large export trade. In the agricultural region of Leon, the chief centres of production are the districts of Bierzo, Béjar and Legueros in the provinces of Leon and Salamanca. The district of Areanas de S. Pedro, in the province of Avila, is also important. The mountain chestnut zone includes La Nera, Hervás, Valencia de Alcántara, Albuquerque, etc., in Estremadura, and extends to the high land of Huelva forming the western end of the Marianican chain. In the opposite direction the chestnut zone extends into the provinces of Vascongadas and Navarre, covering very large areas on the oceanic slope of the Cantabro-Pyrenean chain.

In four provinces the yield of chestnuts is greater than that of apples, as its value exceeds 5 million pesetas (£ 200 000, $ 1 000 000) ; half of this belongs to Guipuzcoa. The total chestnut crop may be reckoned at an average value of 18 million pesetas (£ 700 000, $ 3 500 000).

The varieties most widely grown are : western zone — common or wild Regoldana, and Tagarnizo ; Galicia — Calva (good quality and keeps well), Amarela, Cuancho and Rapada ; at Oviedo — Comun and Balduno (preferred for exportation) ; in Vascongadas — Limousin (early and large, widely grown).

Chestnuts have not spread as much as they ought to have done in Spain. Lately the production has been seriously affected by the " ink disease ", the cause of which is still not known for certain ; no remedies of any value have yet been found. The substitution of the local varieties by the Japanese, which is supposed not to be subject to this disease, is coming to have some importance. Among insects which attack the chestnut may be mentioned, (*Carpocapsa splendana* in Catalonia, and the browntail moth (*Porthesia chrysorrhoea*) in Andalusia and Avila.

Hazel. — Owing to its affinity with the chestut and its adaptability as regards climate, the hazel can be grown in all the cultivated zones of Spain ; it is, however, generally grown isolated in fruit plantations, having industrial importance only in the Catalan provinces of Gerona and Tarragona and on the Sierra de Cordova. In Gerona its principal area is the " Selva " in the district of Santa Coloma de Farmés, while in Tarragona it is grown chiefly about the capital and at Tortosa and Montblanch.

The climatic conditions, with the light yet moist soil, and the facilities for exportation have made nut-growing very flourishing in this zone, which has become a centre of exportation of nuts for the home markets, as well as for England and other countries in the North of Europe.

The Spanish varieties are either long and reddish or round and white. The best known locally are: Mallorquina or Negreta de la Selva, with a large wide nut, shell hard and reddish completely filled by the kernel; Asturiana, with nuts in bunches of three or four, medium-sized or small, the bush being very tall. In this zone the plantations are regular and uniform. In Tarragona nuts are grown with field crops, generally grain, while in the other provinces they are grown in the market gardens or are planted along the ditches or to mark boundaries or beside roads and banks.

In Tarragona, the average yield is about 55 lbs. per bush, worth 8*s* to 9*s* 6*d* ($1.95 to 2.30). The total Spanish crop reaches a value of 13 million pesetas (£510 000, $2 500 000); the exports of nuts from Tarragona to foreign countries amount to 10 million pes. (£400 000, nearly two million $).

Almond. — The almond is the most important of all these trees in Spain from the value it represents. Being more exacting than those so far described as regards climate, it is found in only 11 provinces; its zone is the north and north-east, just the opposite of the chestnut zone. The provinces producing most almonds are Alicante, the Balearic Is., Tarragona, Murcia and Granada.

The hardiness shown by almonds in Spain explains why the plantations have extended and are still extending even in regions in which the crop is uncertain owing to cold weather at flowering time, as in Lerida, Saragossa and Salamanca, whose production alone exceeds a million of pesetas. In Catalonia and the East Coast almond plantations have largely taken the place of the vineyards destroyed by phylloxera.

In Alicante and Majorca the almond is the most important fruit tree, giving a crop worth more than ten million pesetas. Here a great many varieties are grown. On the coast the early varieties are preferred and in the interior and in mountainous districts the later ones. Among the former are Planeta, Columbrina and Castanet with hard shells, and Blanqueta and Mollar with soft shells; the latter group includes Pestañeta, Marcona, Batle and Fina, all hard-shelled. In Catalonia, Comun, Esperanza (semi-hard), Mollar and Desmayo are grown. In Andalusia the varieties preferred are Larga Comun, Larga Fina from Malaga (much liked), Pestañeta and the Mollares types (Comun, Princesa and Sultana). For exportation the best are Planeta, Blanqueta and the Malaga Fina.

Diseases and pests of almonds are fairly numerous in Spain, but rarely do much damage. Insects: *Aphis amygdali, Scolytus amygdali, Carpocapsa splendana, Aglaope infausta, Porthesia chrysorrhoea, Aporia crataegi.* Fungi: *Exoascus deformans, Polystygma ochraceum.* Gummosis is also not infrequent.

Almonds are given little attention in Spain. They are generally grown on unirrigated land, rarely occupying an important position as a

specialised crop; they are planted in grain or pulse fields or among vines olives, carobs or other fruit trees.

The production varies greatly according to climate, variety and treatment. Prof. Estebrich, of Majorca, estimates that an acre containing 32 trees will give 33 bushels of almonds, worth about £10 ($50). The expenses of cultivation work out to at about £4 10s ($22.50), so that the profit will be about £5 10s ($27.50).

Pomegranate. — The pomegranate comes after the trees already dealt with in the scale of ascending climatic requirements; its area of cultivation is much more restricted than that of the almond, about equalling that of the carob.

In Catalonia it occupies 138 acres, but increases in Castile and acquires considerable importance in the provinces of Valencia, Alicante and Murcia; it is less widely spread in Eastern Andalusia, but covers 1700 acres in Cordova. In the last-named provinces the fruit is not of such good quality as on the East Coast, and the value of the crop is only about equal to that of Murcia (£20 000, $100 000). The most noted centres of exportation are Elche and Murcia in the province of that name, and Jatiba, Carcagente and Gandia in the province of Valencia. As this fruit can readily be kept for a comparatively long time, it is sent about a good deal and makes profitable prices.

The varieties grown in Alicante are the Comun and Granilla Blanda; in Murcia, Agriscerra, Cagin and Reineta de Cieza are grown; in Andalusia, Liñuela, Agria, Dolce and Intermedia. The tree is resistant, and attacked only by an aphis; autumn rains sometimes damage the fruit. It is generally planted alone; although it requires a good deal of water, it is otherwise resistant and requires little in the way of attention and pruning and is consequently as profitable as any of the crops already mentioned.

Carob. — This species belongs to the citrus regions, and is grown on the East Coast, in Catalonia and in the Balearic Islands. The province of Valencia alone yields 14 millions' worth (£550 000, $2 700 000), the chief districts being Santungo, Torrente, Liria, Chelva, Carlet and Jatiba.

The carob is much grown on the poor land of the littoral zone, known as " La Marina ", as well as in the foothills of the ranges running parallel to it, up to 1300 ft. In Spain the fruit is used almost exclusively for feeding the draught animals; it is a nutritive and wholesome food. The exported product goes for the same purpose.

The varieties chiefly grown in Valencia are the Casuda (very productive and everywhere used for fattening pigs), the Roja (so called from its red colour), the Matalafera (with large fruit), Blanca, Negreta and Melar. In the Balearic Islands we have: Miel, Vera and Roja, preferred for their quality, as well as Panesca, Acanalada and Bobal.

The enemies of the carob in these regions are the scale (*Aspidictus ceratoniae* and the wood-boring leopard moth (*Zeuzera aesculi*).

The average crop of a 40-year carob tree may be taken at 110 lbs. The official statistics give a value of £1 244 300 ($6 055 300) for the carob crop of the whole of Spain.

The Present Condition of Cattle Breeding in Hungary

by

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Up till the second half of the 19th century, when railways began to be constructed, Hungary suffered from deficiency in means of communication ; this, together with the extensive cultivation practised, necessitated a very considerable use of animals for draught purposes. For this reason, it was necessary to raise a breed sufficiently hardy to be able to stand great extremes of climate, poor feeding and little care. Such a race of cattle is the Hungarian. These animals have long horns and silvery white coats ; and until 1850-1860 represented the majority of the Hungarian cattle, not counting the mixed breeds found in districts where there is no idea of breeding. The Hungarian cattle are thrifty and can bear alike the extreme heat of summer and the great cold of winter. Further, as they are resistant to disease and can stand very hard work, they became the animated motor which was indispensable to Hungarian agriculture. They occupy the same position now, especially in districts where the roads are bad and the cultivation of the soil does not require more powerful labour.

Less early in maturing than their western relatives (for this breed does not reach maturity until it is nearly four years old), the Hungarian cattle cannot be yoked for a year or a year and a half later than the former. But, on the other hand, their powers of work do not vary for 8 or 10 years, and they can be used for the hardest agricultural work, for 10 or 12 hours every day, no matter what the weather. Although Hungarian cattle do not fatten as well as the western breeds, by careful selection they can develop into fairly good beef producers, though, as regards milk production, they are still inferior to the western breeds. However, in the last century, these qualifications were of little importance, for the Hungarian cattle were only bred for agricultural work. Even 20 years ago, meat, milk and milk products formed a very small part of the diet of the agricultural and artisan population ; for this reason, for many centuries Hungary has not felt the necessity of improving this breed so as to obtain better and more profitable animals.

Now, however, she is forced to take this step by the following circumstances :

1. The development of cultivation.
2. Rapid improvement of the means of communication.
3. The increased meat consumption.
4. The continually increasing cost of rural labour, and the fact that farms based entirely on grain growing are no longer remunerative.
5. The necessity of practising a more intensive system of cattle breeding with a view to maintaining agricultural equilibrium.

It was chiefly the large landowners who, at the close of last century, modified their farming methods by importing breeds of cattle from the western countries; with these they founded dairy farms, keeping the Hungarian cattle for draught purposes. Gradually, the western breeds began to gain ground in the districts where the estates of these proprietors were situated, both by the purchase of improved animals and by placing the services of bulls at the disposal of the inhabitants.

But these landowners did not follow any special aim and merely imported such animals as pleased their taste; further, they soon began rearing different breeds, with the result that, in a few years, Hungarian cattle became such a confused medley of crosses and different breeds that they decreased in value.

Legislative Measures. — To restrain this indiscriminate breeding, the Ministry of Agriculture has endeavoured, since 1890, to direct these efforts more in accordance with the soil and climate, and to induce breeders to profit by the experience gained abroad. At first, the Government gave little encouragement to these improvements, either by its moral support, or by grants for the importation of breeding stock or the establishment of dairies.

But later, law XII of 1894, dealing with agriculture and rural economy, brought about a great advance in the work of reforming stock breeding and cattle breeding in particular. District Agricultural Commissions were formed, one for each district of the county, of which the members are: the first administrative functionary of the district, the chief judge of the district, two experts in agriculture and cattle breeding and one veterinary surgeon. This commission is entrusted with the following duties:

1) To insist that the Communes keep the required number of sires of the right breed in the breeding districts appointed by the Ministry of Agriculture.

2) To control the quality of the animals by means of annual inspection.

3) To draw up certificates, valid for one year, for male animals suitable for sires.

4) To practice selection.

This law also regulates grazing, and provides that the communal Council shall arrange, by means of regulations, for the custody of cattle in pastures. These animals must only go to the communal pastures in herds and according to their breed. As regards communal grazing land, the Executive Communal Council fixes: 1) the number of animals grazing on such land; 2) their distribution thereon; 3) the season of grazing; 4) the amount of the grazing dues, etc.

From the above-mentioned date, the Ministry of Agriculture took increasing interest in the development of the breeding of national cattle, proportionally increasing its financial support. According to its provisions (law XLIII of 1908 on the development of cattle breeding) all the county tribunals are required to draw up, within a given time, regulations regarding

cattle breeding. These regulations, while based on existing conditions, shall establish the lines to be followed in general breeding, regulate the purchase of bulls destined for the general use, as well as the care, keep, and use of these animals, and shall in general contain all the necessary measures to be adopted in systematic stock breeding.

In order to increase the good results of these provisions, the Ministry of Agriculture instituted in 1895, the Royal Hungarian Inspectorships of Cattle Breeding. The number of these inspectorships, whose sphere of work extended at first over several counties, increased from year to year, so that in 1912 each of the 63 counties had its own inspector. As, however, the work of the inspectors had extended to all the branches of agriculture, they now carry out their work in each county under the new title of Royal Hungarian Inspectors of Agriculture.

The work of these Royal Hungarian Inspectorships consists of:

1) The control of the strict carrying out of the ministerial ordinances and of the laws relating to agriculture.

2) Participation in the operations of the agricultural commission of the district.

3) Control of the purchase of breeding stock.

4) Giving of State aid in certain cases, taking into consideration the financial condition of the communes.

5) Regulations of the direction in which breeding should be carried out.

6) Organisation of cooperative dairies.

7) Improvement of pastures.

8) Encouragement of the acquisition of meadows.

Finally, law XXIII of 1912 on the administration of agricultural matters in the counties and municipal boroughs having conferred upon the agricultural inspectors the right of administering the agricultural affairs in these places, the inspectors are required to act as reporters on agricultural questions to the administrative tribunals and to deal with all matters in the territories of each county which come under the jurisdiction of the Ministry of Agriculture.

State Encouragement. — In order to promote cattle breeding, the Ministry of Agriculture has facilitated the purchase of bulls required for communal breeding. While, in 1890, the grants towards the development of breeding only amounted to 100 000 crowns (£4 167), in 1913 a sum of over 6 million crowns (£250 000) figured in the budget for the purchase of communal bulls. Thanks to this assistance, more than 8000 sires were acquired in 1913 for communal breeding; of these $^4/_5$ belonged to western breeds and $^1/_5$ were Hungarians. Further, the Ministry of Agriculture, in co-operation with the county agricultural associations, organises cattle shows every year, in all the districts of the country; during the last few years, prizes exceeding 300 000 crowns (£12 500) have been annually distributed at these. The State also insures communal bulls, from the first year of their acquisition, against death or compulsory slaughter. In 1913, the insurance premiums reached £7208. The State also rewards

good management, feeding and practical use of stud bulls ; in 1913, such awards amounted to 30 000 crowns (£1250).

New lines of breeding. — The new aims of the cattle breeder, as set forth by the Government, were the transformation of the existing stock by means of the importation and raising of breeds from Western Europe. He was to aim at early maturity, milk yield and the production of beef and manure. This new departure has produced a radical change in the cattle of Hungary during the past twenty years.

It is true that many Hungarian cattle breeders, fearing the degeneracy of the native race, and consequently the decadence of the Hungarian breeding industry, tried to improve the former by rigorous selection and better feeding, so as to render it equal in production to the western breeds without forfeiting its special characteristics, thriftiness, strength, capacity for work, etc. Nevertheless, most of the Hungarian breeders, doubtful of the results of these efforts, practised the new system by raising the western breeds most suited to the environment and thus followed the scheme laid down by the Ministry of Agriculture for each district ; for the country was divided into breeding districts for different breeds.

The first foreign cattle were raised in Western Hungary, and their breeding gave such satisfactory results, that this zone became for many years the source of supply for all bulls for crossing purposes and its export trade also increased annually.

The cattle bred here, known as the Bonyhád district breed, were obtained by crossing Kuhlands (Moravian) with Simmentals (Swiss) ; but after some years, when the breed was perfectly selected and improved it was bred in pure lines and much prized for its good milking and fattening properties. In this region, the organisation of dairy companies and of cooperative dairies advanced parallel with the extension of the western breed. The production of forage crops took a considerable place in the rotation ; rich manure was obtained and thus the new system of breeding received so great an impetus that this district served as a model to others. By its financial assistance, the Ministry of Agriculture also facilitated the purchase of bulls in other districts where the local conditions permitted the economic breeding of the Bonyhád cattle.

Importation of breeding cattle. — Hungarian cattle breeders, however basing their objections upon experience obtained abroad, were not content for long with the results obtained by local breeding ; consequently the importation of animals to keep up the blood assumed continually increasing proportions. The Ministry of Agriculture defrayed the expenses of the purchase and transport of these animals, and in many cases also advanced the sums necessary for their acquisition as a long-term loan without interest. Further, the Ministry lent the services of its experts to the agricultural associations on the occasion of purchase. Thanks to this assistance, over 3000 animals were annually imported, mostly from Switzerland and the Austrian Alps. The greater number of these are placed with small breeders and only a few go to farms of medium size. Amongst our large landowners there are many who, without any State grant, have transformed

their stock to such an extent that dairy herds of four or five hundred western cattle are not at all rare.

In 1913, with the help of the State, 2433 first class cows and heifers, to the value of £111 500 were imported from Switzerland for small and average breeders. The annual milk yield of the imported cows exceeds 660 gallons, and some give even 1320 gallons.

Breeding districts. — During the last twenty years, the country has been divided into breeding regions for different breeds, with the result that the Simmental cattle are found in the greater part of Hungary, wherever the conditions suitable for raising a more exacting breed are found. In many of the north-eastern counties, notably in the mountainous districts, the cattle belong to the Gray-Alpine breed (Montavon and Algäu). In order to improve these breeds, some 200 or 250 bulls of the Gray breed from the Austrian Alps are annually imported with the assistance of the State. In one part of the Alföld and in some of the counties of Transylvania, the breeding of the old Hungarian cattle still predominates, on account of the inferior conditions of cultivation, the vast extent of the pastures, and the bad transport conditions. Although the Ministry of Agriculture favours equally the raising of this breed, no hindrance can be put in the way of the extension of the western breeds, so that even in these districts, the Hungarian race is yearly decreasing in numbers.

In some districts, especially in some of the counties of the north and south-east, in order to help the substitution of the breeding of western breeds for that of native cattle, an attempt has been made to acclimatise the Pinzgau breed. These animals are hardy and have been bred with such success that the Hungarian ones can compete successfully with those from the Tyrol, whence the breed was imported. As the Pinzgau cattle, however, only served for a transitional period, during which the breeders have acquired, on the one hand, ideas of systematic feeding and the use of the animals, and on the other, have adopted intensive cultivation, they will gradually be replaced by the Spotted Simmental breed.

Such is to-day the summary of the distribution of cattle rearing in Hungary, divided according to the different breeds.

Cattle Statistics. — The rapid extension of the western breed and the corresponding decline in the rearing of the Hungarian, have given rise amongst agricultural societies to the idea, based on erroneous statistics, that during the last decades our cattle breeding industry has been progressively decreasing and cannot keep pace with the increase in the population. This statement is based on the growing dearness of meat. However, on examining tables I and II, which give the data relating to the increase in cattle and their number in proportion to the increased population and the area of the country, it is seen that these has been no falling-off in cattle rearing between 1895 and 1911, but that on the contrary, the fact that the increase in population has only amounted to 14 per cent, while that in breeding animals and milch cows is 17.7 per cent and 42.5 per cent respectively (the stock having improved in quality and value) shows a decidedly upward tendency. On the other hand, if the cattle have not increased

in proportion to the population between 1895 and 1911, this is due to the following circumstances : 1) the rapid increase in the consumption of meat, which during the last decades has exceeded the production; 2) the great development of the export trade, both to Austria and abroad.

The following comparison shows the rapid increase of our export trade in cattle, and their products :

Year	£
1881.	910 427
1894.	3 637 996
1904.	7 172 405
1912.	7 509 215

TABLE I. — *Cattle.*

Year	Total cattle	Breeding animals	Cows.	Percentage of cows as regards	
				total number of cattle	breeding animals
1895	5 829 018	3 757 419	1 872 148	32.1	49.8
1911	6 183 424	4 406 659	2 667 175	43.1	60.5
Increase . . .	354 406	649 240	795 027	—	—
» % . .	6.1	17.2	42.4	—	—

TABLE II. — *Number of cattle in proportion to area and population.*

Year	Per square mile			Per 1000 inhabitants		
	Total of cattle	Breeding animals	Cows	Total of cattle	Breeding animals	Cows
1895	53.35	34.39	17.25	363	234	116
1911	56.62	40.35	24.42	338	241	146
Increase or decrease. . .	+ 3.27	+ 5.96	+ 7.27	— 25	+ 7	+ 30
» » » % .	+ 6.3	+ 17.7	+ 42.5	— 7	+ 3	+ 27

From 1895 to 1910 the increase in population was 14 per cent. The area of Hungary is 109 221 sq. miles.

According to the statistics of foreign trade, the exportation of live stock (chiefly cattle) and their products during the last decades has exceeded that of cereals and flour. This is due to the radical transformation in our cattle which has taken place and is still continuing. Table III shows the changes between 1884 and 1911.

TABLE III. — *Changes effected in cattle* 1884-1911.

Date of census	Cattle				Buffaloes		Totals
	Hungarian breed		Spotted breed		Number	%	
	Number	%	Number	%			
1884	3 819 898	78.3	939 495	19.3	119 645	2.4	4 879 038
1895	3 756 137	64.5	1 940 303	33.2	132 578	2.3	5 829 018
1911	1 872 790	30.3	4 154 442	67.2	155 192	2.5	6 183 424

The summary we have given and the results obtained, prove the highly progressive nature of the policy of the Ministry of Agriculture as regards cattle breeding, and show that the material sacrifices made have borne good fruit, and that the agricultural public, recognizing the truth of these facts and the necessity of further development along the same lines, follow the well-chosen path which will raise Hungarian agriculture to the level attained in the Western countries.

The Distillation Industry in Italy

by

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In Italy, distilling is not subject to the continual and rapid changes occurring in the other industries which are dependent on products of agricultural origin. Rather than as an article of consumption as food, alcohol is of importance as being the raw material, or a factor in the manufacturing processes, of certain industries — industries of slow evolution and of uncertain progress. But anyone examining the statistics of the returns which distilling brings to the Treasury would arrive at a conclusion totally different from that expressed above. To explain the apparent contradiction, it is only necessary to compare the figures of production with those of the taxes on the manufacture of alcohol.

The amount of the product either diminishes or remains stationary; the fiscal returns increase only because the Government tax on distilling is augmented, and unfortunately the Italian fiscal system lays no light hand upon this industry which is so intimately bound up with the lot of national agriculture.

The principal source of Italian alcohol is not wine and its residues (as, considering the importance of vine growing, one might expect), for except in years of exceptional vintage, alcohol is obtained from an entirely dif-

ferent source. The employment of large quantities of vinous substances when the vintage is exceptionally heavy is due to the provisions of the fiscal decrees made provisionally by the Government, which, as a rule, reduce the tax on manufacture by one half.

The substances which are used in Italy for the production of spirit are : *cereals, sugar factory residues, sugar beets, wine products* (wine and pomace), and a small quantity of other substances and *fruit.*

The distillation of cereals — in distilleries of the *first category* — has already lost some of its former importance, and cannot be considered stricly speaking, as of a national character, since, as is well known, Italy is obliged to supplement her home-grown cereals by the importation of several hundred thousand tons annually in order to supply her population with food. The industry manages to exist on account of the low price of the foreign raw material, the utilisation of the inferior and waste products, and the considerable yield there is in spirit. The residues of this industry are useful in cattle rearing. In 1910-1911 (1) 18 902 tons of cereals were distilled, with the average yield of 75.60 gals. of absolute alcohol per ton and a total production of 1384 550 gals. of absolute alcohol. In the following financial year 17 208 tons were imported and gave a yield of 34.24 per cent. and a product of 1 317 032 gals. of absolute alcohol (2).

The cultivation of *sugar-beets*, especially in the great valley of the Po, has extended more than would have been considered possible under the climatic conditions which obtain. This is, however, due to a real bounty given by the Government, which imposes a considerably lower tax upon sugar extracted from this plant than that which is put upon foreign sugar imported into Italy. Hence the amount destined for the still is considerably increased, either directly, or indirectly as molasses.

In fact, in 1910-11, 11 938 tons of sugar-beets were distilled, with an average yield of 7.27 per cent and the production of 194 858 gals. of alcohol; in the financial year 1911-12, 15 476 tons, with a yield of 6.14 per cent and the production of 212 365 gals. of spirit. The figures referring to *molasses* are much more considerable : while in 1910-11, 55 332 tons were utilised, with a yield of 27.43 per cent. and a production of 3 392 295 gals. of alcohol, in the following year 43 114 tons were distilled, with a yield of 28.66 per cent and a total yield of 2 761 845 gals. of alcohol. The *washings of yeast*, also a by-product of sugar-making, contribute to the amount of alcohol obtained from the sugar-beet ; in 1910-11, 13 505 tons were used, with a percentage of 2.93 and a total of 88 909 gals. of alcohol, and in 1911-12, 15 589 tons, with a percentage of 3.27 and a production of 114 484 gals. of alcohol.

(1) I refer to the financial years 1910-1911 and 1911-12 because they represent a period of fiscal tranquillity and normal production ; the preceding and following years were too much affected by alterations in the taxes on manufacture or by abnormal conditions of the wine and sugar-beet markets.

(2) The figures given in this article are not the quantities of distilled liquids actually produced, but the quantities of absolute alcohol they contain. (*Ed.*).

Italy is, at the present time, the country which produces the greatest quantity of *wine*; her production certainly exceeds that of France. The official statistics of the last years attribute to her on an average about 1 100 million gals. of wine; as a matter of fact the production is much higher: the excess escapes the notice of the persons entrusted with the collection of the data, because there is but one sure coefficient in the system of estimation, namely that of the area under vines, while the annual return of the vineyard is left to individual valuation and to the uncertainty of too restricted investigation and to inaccurate estimation (1).

In any case, even if we accept the Government figures, it is easy to see that the production is greater than the consumption; the various wines and the grapes exported, returned for the sake of convenience under the head of wine, do not exceed 33 million gallons and only relieve this excess of production to a very small extent.

It would thus be an obvious deduction that wine and its residues, especially pomace, were the raw products that would supply the distilling industry. That this is not the case is clearly shown by the following figures.

In 1910-11 there were distilled in the distilleries of the 2nd category subject to direct control of their returns, 1 669 976 gals. of wine, with a yield of 8 per cent and a production of 133 687 gals. of alcohol; in 1911-12 the amount of wine distilled decreased to 239 096 gals., with a percentage of 7.52 and a total yield of 17 983 gals. of alcohol.

In 1910-11, 138 447 tons of pomace were used, giving a percentage of 2.80 and a yield of 867 664 gals. of alcohol; in the following financial year, 162 792 tons were turned to account, corresponding to a production of 1 073 184 gals. of alcohol with a yield of 2.95 per cent.

Only a small quantity of dried grapes were distilled; these came for the most part from abroad (Greece), whence were obtained: in 1910-11 3253 gals. of alcohol from 76 tons of grapes, the average yield being 19.20 per cent; and only 569 gals. in 1911-12 from 20 tons of dried currants, which gave a percentage of 12.74.

Besides those distilleries of the *2nd category* which distil wine and pomace, we must not omit to mention others that are not subjected to registering appliances. Such are the distilleries of the large number of modest country producers using apparatus of small capacity, who are accorded special treatment under the law, since it subjects them to direct taxation in proportion to the daily production of their stills, without direct and continuous superintendence, which is impossible on account of their number.

These distilleries used, in 1910-11, 32 626 gals. of wine with an average yield of 6.50 per cent and a total production of 2117 gals. of alcohol, and in 1911-12, 8822 gals. of wine which gave a percentage of 6.67 and a yield of

(1) According to the recent publication of the Min. of Agric. entitled "Il Vino in Italia" (Rome 1914), the average returns of the five years 1909-1913 were about 1012 million gallons. (*Ed.*).

588 gals. of alcohol. In 1910-11 they distilled 8655 tons of pomace, which, with a percentage of 2.69, yielded 52 076 gals. of alcohol; and in the following year 6021 tons at 3.25 per cent, which yielded 43 767 gals. of alcohol.

From these data, it is easy to see that these small distilleries are managed directly by the vine-grower, who, especially in Upper and Central Italy, gives much of his time to them in winter when the bad weather puts a stop to field work. It is a small but paying industry, in spite of the disadvantages under which it labours owing to high taxation, for the low grade alcohol produced is consumed direct as a stimulant. Nor, after all, is it a bad thing that obstacles should be placed in the way of this product, which is of inferior quality and is obtained by imperfect apparatus; a supreme interest — that of public health — demands such a course, since to this inferior spirit (pomace brandy) is due the increase of diseases caused by alcoholism in some provinces of Venetia (Udine and Belluno).

For the purpose of keeping this crowd of small speculators in better order, and at the same time facilitating the distillation of wine products and spreading the feeling of cooperation in the country districts, the Government gives special fiscal privileges to *cooperative distilleries*.

To these distilleries of the second category, that is such as are furnished with an automatic meter, was accorded as compensation for shrinkage, possible leakage, or any other loss, including the imperfect registration of the meter, an abatement on the manufacturing tax varying from 30 to 45 per cent. according to whether pomace or other residues of wine making are being distilled, or wine. Naturally this abatement is only granted to such associations of landowners and growers as use their own produce. By Royal Decree of November 27, 1910, following that of September 24, which raised the distilling tax from 7*s* 3*d* to 9*s* 9*d* per gal. of absolute alcohol, the above-mentioned abatements were lowered by 8.65 *d* per gal. of alcohol; later this remission was only granted in the case of those cooperatives that produced at least 11 000 gals. of spirit annually.

These regulations seemed to have attained the aims proposed by the central administration of finance, seeing that in 1910-11 there were already 101 of these cooperatives, only 71 being at work. Unfortunately , it was but a temporary activity, since they soon decreased, so that in the financial year 1911-12 there were only 40 cooperatives working, and their number shows signs of still further decreasing. Thus, while in 1910-11 2 252 712 gals. of wine were used, with a yield of 225 778 gals. of alcohol and 16 311 tons of pomace, with the production of 107 621 gals. of alcohol, in the following year there were only 8 946 gals. from 100 430 gals. of wine and 155 694 gals. from 22 514 tons of pomace.

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The legislation dealing with distilling should not only safeguard the direct interests of the national Treasury, but also encourage industries that use alcohol either as raw material, or as a factor in their operations, and it was sought to attain these ends by remitting, or reducing, the taxes, or by granting considerable relief in the form of abatement.

It is only by these means that the manufacture of alcohol to be used in the industries can be kept up. This alcohol is denatured in such a way that it cannot be used for making cognac, artificial vinegar, etc.; it is then employed as fuel and in the manufacture of fulminate of cotton, of collodion, artificial silk, photographic paper and films, paints and lysoform.

Special provisions were further adopted to promote the export of types of wine which require a high alcohol content, such as *Vermouth*, *Marsala* and *Moscato*, thus granting them a real bounty of industry which especially benefits Sicilian and Piedmontese wine-making.

Denaturated alcohol, which suffers from severe competition with petroleum, was freed from all fiscal dues and octrois; it was also granted an abatement varying from 8 to 18 per cent according as it is ascertained to be made from vinous substances or not, these being allowed the greater reduction.

In the financial year 1910-11, the adulterated spirit obtained by the distillation of wine and its residues amounted to 230 461 gals. of absolute alcohol, and the next year to only 122 914, while the amount obtained from other sources was 2 214 873 gals. in 1910-11 and 2 278 442 in 1911-12, although the reduction of the tax was considerably lower.

It is interesting to see how alcohol is employed in the so-called *privileged industries*, and thereby an indea can be formed of their importance; for this purpose the following figures showing the amount of alcohol used in 1912 will serve:

	Gallons of absolute alcohol	
	from vinous substances	from non-vinous substances
For lighting purposes	119 148	1 948 439
For the manufacture of fulminate of mercury	—	3 291
» » » sulphuric ether	—	871
» » » artificial silk	541	40 745
» » » various paints	—	267 927
» » » photographic films and plates	241	1 596
» » » lisoform	—	34
Total	119 930	2 263 714

The manufacture of cognac seemed at one time likely to play an important part in the utilisation of spirit and to absorb large quantities of wine, especially those made in the districts least favoured by Nature, where acid wines of low alcoholic content are produced; such are the foothills of the Alps, the upper windings of the valley of the Po, and the mountainous districts of the peninsula and the islands. The manufacture of cognac

was hailed with satisfaction by vine-growers and the Government, because they hoped to be able to withdraw from the market the by no means inconsiderable quantity of these inferior wines which from their low prices interfere so seriously with the consumption of wines of good quality and enter into competition, often with disastrous results, with the produce of districts which are more adapted to the cultivation of the vine.

Unfortunately the results did not justify these hopes, and the Government, after it had been proved that these fiscal concessions had been exploited for private and unworthy speculative ends, was obliged, and in our opinion rightly, to take restrictive measures.

The law of December 3, 1905, ratified the old concession that grape brandy destined for ripening for the manufacture of cognac, should be kept untaxed in bonded warehouses, similar to private bonded warehouses for alcohol, until the time of sale, with special guarantees to safeguard the Treasury, but without the payment of any security, and should be accorded in consideration of loss and refining an annual abatement of 10 per cent on the amount of spirit originally introduced, so that after the tenth year all the brandy was completely free from any fiscal tax. For greater convenience, it was permitted to remove and sell the quantities yearly allowed as abatements, a practice which had serious drawbacks, since the brandy in question, being free from fiscal duty, could be used for other purposes than those intended by the legislator, and at so low a price that it become a formidable competitor of alcohols burdened by an excise tax.

The result was that the law of September 16, 1909, defined more clearly and specifically the qualifications which must be possessed by brandy destined for keeping. It must have a good taste, an alcohol content not above 65° and be placed in unlined oak casks free from any varnish and not exceeding 220 gals. in capacity.

After it has been stored in this way for four years, the duty on it is reduced by an abatement of $^4/_{20}$ of the duty it should have paid, and in the following years up to the twelfth, the abatement is reduced to $^1/_{20}$ per annum. The original provisions remained in force in the case of distilled products placed in the storehouses before the promulgation of the law of May 18, 1909, the date on which the law in question was presented to the Chamber of Deputies. Later (law of June 12, 1912) it was decreed that the abatement, instead of being conceded in kind, should rather be reckoned on the amount of the duty which the spirit, intended for the manufacture of brandy of the cognac type, should have paid at the time of its introduction into the refining storehouse.

In the bonded storehouses of cognac in 1911, spirits containing 76 736 gals. of absolute alcohol were stored; this amount rose in 1912 to 212 598 gals. subject to the provisions of Art. 9 of the law of September 10, 1909; further there were 4 229 698 gals. belonging to the year 1910-11, reduced in the following year to 3 288 164 gals., stored under the provisions of the preceding law. To this large amount must be added 1 880 203 gals. (1912) consisting of a distilled product which was in the storehouse

n May 18, 1909, but not in the storage conditions prescribed by Art. 9 f the above-mentioned law and which is subject to other fiscal regulations. Thus the amount of spirit lying in the storehouse to mature and belonging to the vintages of years of former vine-growing crises is still very large, ince there were used in its manufacture much wine of the exceptional vintges of the last few years which had not found a suitable place on the narket as beverages, and thus it is a heavy burden on the State budget. The State tried to relieve itself of this incubus by the above-mentioned nasures and by the readjustment of the manufacturing tax, which was ffected by Royal Decree of January 1, 1914, which was applied without revious warning.

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Let us now turn to another *privileged industry*, that of the production of *inegar* from alcohol. It is certainly strange that, considering the amount of vine she makes, Italy is obliged to have recourse also to alcohol in order to ncrease her vinegar supply. For this there can be but one explanation, *iz.* that for certain industries, notably the preserving of garden produce and he preparation of pickled fish, wine-vinegar, at least as at present preared, is not very suitable.

The makers of *artificial vinegar* can get the alcohol they require by aying only ⅓ of the manufacturing tax if the alcohol is produced by listilleries in the 1st category ; 2*s* 2*d* per gal. of absolute alcohol if it is btained from wine. They can store it, the tax being suspended, till the ime of use, in bonded stores which have two keys, one of these being kept y the technical finance office, as is prescribed in the case of the Excise torehouses for brandy.

The amount of spirit used in this industry was 1 149 550 gals. in the nancial year 1910-11, and 1 386 964 gals. in the following year, 1 100 000 nd 1 226 280 gals. of *vinegar* being respectively obtained.

To the alcohol added to *typical* wines, such as *Marsala*, *Moscato* and *ermouth*, which are exported abroad and blended without the supervision f the Customs, 90 per cent of the whole manufacturing tax is remitted; he same reduction is made in the case of the spirit added to must or to uits, or exported either as such or as liqueurs, and of that used in the prearation of vinegar, extracts, perfumes, etc.

The wine-making industry, however, derives considerable benefit from his arrangement, since in calculating the reduction it is reckoned that the atural alcohol content of the wines used in making the typical wines is 1 degrees in the case of Vermouth and 13 in that of Marsala. The maxmum amount of alcohol on which the reimbursement is made is 18 degrees n the case of the first and 23 in that of the latter. It is well known that icilian and Sardinian products are used in making these wines ; the first ontain 16 ½ and 17 ½ per cent. of alcohol of fermentation, and the latter 5 per cent. The new fiscal regulations set no restriction (as was the case rmerly) upon the amount of exported alcohol which shall profit by the emission of the tax within the above-given limits.

The value of the total amount of alcohol used for this industry without the supervision of the Customs was £77 476 in 1910-11 and £55 444 in the following year ; that of the alcohol added under the supervision of the Customs was £261 056 in the financial year 1910-11 and £185 198 in that of 1911-12.

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Distilling apparatus. — The power and the kind of apparatus used in distillation differ according to the importance of the industry which is carried on. In distilleries of the 1st category, that is those using the fermented products of the saccharification of starch-containing substances (sugar-beets, molasses, etc.), the apparatus is provided with an automatic meter, and the taxation is based on the alcohol of the first production.

Of these factories, which are scattered more or less throughout the Peninsula, but especially in the North and Centre, there were 34 working in 1910-11 and 36 in the following year ; they yielded in the former financial year 5 105 198 gals. and in the latter 4 408 979 gals.

Italy has no important makers of distilling apparatus or special apparatus of its own make for this industry. A laudable attempt to supply this want has, it is true, been made by Messrs. Erba and Mussi of Milan, but the greater number of these apparatus (56) are of foreign manufacture. The most common types are those made by Barbet, Egrot, Pampe, Frevet, Singes, Savalle and Guyllaume, coming from France and Germany.

The distilleries of the 2nd class, those using wine and vinous substances subject to the direct estimation of the product, are very numerous, being more than a thousand. An average of only 800 of them are, however, at work, giving an output of 1 033 531 gals. in 1910-11 and 1 115 477 gals. in the following year.

The number of those which belong to the category of distilleries taxed in proportion to the daily output of the stills is legion, in spite of the impossibility of any active continuous supervision. There are over 4600 of such distilleries, although only about half (from 2000 to 2300) are working. In 1910-11 they produced 54 547 gals. and in the next year 44 811 gals. It is, as a rule, the vine-growers themselves who practise this branch of the industry, and they take the place in Italy of the *bouilleurs de cru* in France. The apparatus used by them are most various ; some of them are representatives of the stills belonging to the early period of distillation in the times of Lulli and Savonarola. There are, however, not wanting, especially in distilleries of some importance where automatic meters are used, modern and scientific apparatus, of which some very good ones are made in Italy by Messrs. Michelerio of Casale, Da Ponte of Conegliano, Mussi of Milan, etc. Much plant has been introduced from France, particularly since the competitions of distiller's apparatus held by the Government at Conegliano and S. Miniato (Florence). The types of apparatus that meet with most favour are those made by Villard-Rotner, Egrot and Deroy.

* * *

The output. — The amount of alcohol produced has reached its present ure very slowly. To quadruple the output it took forty years, for nile it amounted to 1 430 000 gals. in 1874, it is now about 5 720 000 gals., with the inevitable oscillations due to the uncertainty of the vintage and of the sugar-beet crops. In order to increase it further, a difficult thing under existing conditions, it would be necessary for some impetus to be given to the industries dependent on alcohol and not to direct consumption, for important hygienic reasons.

In the two years which have been taken as the basis of our demonstration and which, it is said, represent a period of unusual relative fiscal stability, the amount of absolute alcohol produced was as follows :

	In 1910-11	In 1911-12
	gallons	gallons
By distilleries of the 1st category	5 105 198	4 408 979
By distilleries of the 2nd category subject to direct control	1 033 531	1 115 477
By distilleries of the 2nd category not subject to direct control	54 547	44 811
By cooperative distilleries	333 399	164 647
Total . . .	6 526 675	5 733 914

The tax on manufacture at the rate of 9*s* 9*d* per gal. of absolute alcohol, if none of the abatements mentioned were accorded, should have amounted to £2 873 043 in the financial year 1910-11 and to £2 715 043 in the next ; but the returns obtained by the Treasury were only £1 526 470 in 1910-11 and £1 651 000 in 1912, since the manufacturing tax was increased by 8.65*d* per gal.

This small increase, which seems to have had an influence upon the amount of production, was but the first indication of the imposition of a heavier tax. In fact, by Royal Decree of January 1, 1914, the manufacturing tax was raised to 11*s* 11*d* per gallon of absolute alcohol, almost the heaviest imposed in any alcohol-producing country where this product is not a monopoly. Seeing that, after the tax was raised to 11*s* 11*d* many illicit stills were discovered and grave abuses in the rectification of denatured alcohol were detected, it is allowable to conclude that by this measure the Government will not obtain the hoped-for advantages to the Treasury, in spite of the greatest vigilance being exerted.

In Italy, the fiscal system regulating the taxation of alcohol has no stability. Whenever there is a change of the Minister of Finance, which occurs, on an average, every two years, the tax is raised or lowered, so that the distilling industry has a very agitated existence which does it more harm than the heavy taxation itself.

In 1864, alcohols paid octroi from 2.59 to 5.19*d* per gallon of absolute alcohol if they did not exceed 59° of the Gay-Lussac scale, or 4.32 to 8.65*d* if they did exceed it, according to whether the communes were open or closed ; in 1914, as we have said, the tax was raised to 11*s* 11*d* and it

seems likely to be further increased, unless the Government is obliged to return to a lower figure, as happened in 1879 on account of the serious crisis which ruined the industry, owing to an unreasonable augmentation of the tax.

In order to temper the effect of the distillation tax upon the wine-making industry and to equalise its effects in proportion to the yield in comparison with that obtained from starch-containing substances, the law of 1909 granted a reduction of 35 per cent to factories provided with a meter and which distilled wine and second wine, except where this was obtained from the pomace washings, and of 25 per cent in the case of those using fruit and pomace. This abatement was increased to 1*s* and 1*s* 7½*d* respectively for co-operative distilleries legally constituted, and belonging to land-owners and vine-growers, always provided the substances used for distillation were their own products, and the annual output, as we have already said, amounted to at least 11 000 gallons absolute alcohol. It is in the power of the Government to increase up to 50 per cent the abatement of the distillation tax on wine when the vintage is proved to be exceptionally abundant. This provision, it is true, succeeds in momentarily relieving crises of vine-growing, but it disturbs the spirit market and renders it heavy in the years immediately following them. We have touched on the other reductions when speaking of the various privileged industries.

Free distillation in Sardinia. — In order to render less disastrous the conditions of wine-growing in Sardinia, in 1897 it was decreed by the special law for the benefit of this island that wine and other vinous products of local origin might be distilled free from tax. The distilled substances could only be introduced into continental Italy on the payment of the full distillation tax. The addition of alcohol to the wine exported was allowed up to 15 per cent of total alcohol; (the average alcohol content of the common table wines of the *Campidani*, which is commonly exported, can be estimated at from 13½ per cent to 14 per cent). This provision gave the island an annual gain of about £20 000, but it is in fact but a tardy and partial restitution of certain portions wrongfully imposed upon the sum of the ground-rent with which the island was burdened in comparison with those of the rest of the State, depending on the abolition and redemption of the feudal dues and ecclesiastical tithes, carried out at the expense of the island, while the Government appropriated a large part of the so-called *beni ex ademprivili* which ought instead to have been absolutely and completely communal property.

This concession was really beneficial to Sardinia, but Sicily and Piedmont also obtained from it indirectly no small advantage in the most serious period of the phylloxera crisis, for their *Marsala* wines and *Vermouth* respectively. In Sardinia, the phylloxera is spreading and threatens the total destruction of the *Campidani* vineyards, so that the day will come when the island, instead of exporting wine, will be obliged to import it for its own consumption, and thus the value of the concession granted in 1897 will become less, and advantage will only accrue to the small local trade in spirits under the form of liqueurs and brandy, of which, especially in

the mountainous districts of the centre and in the north of the island, there is a certain, though somewhat limited, consumption.

The spirit trade. — This branch of Italian trade has not in itself great importance; nevertheless it deserves some mention.

In 1911, 45 474 gals. of *pure spirit* in casks and barrels, to the value of £2871, were exported; in 1912, only 16 588 gals., to the value of £1047, and in 1913, 98 472 gals., fetching £6 217. More important is the export of *sweetened* or *aromatised pure spirits*, which are sent to France, the Argentine, Brazil, the United States, etc., in casks or bottles. This trade brought in a total of £401 804 in 1911, £393 354 in 1912, and £327 435 in 1913.

The amount of our *cognac* exported is very small, only realising (in casks and bottles) £16 342 in 1911, £8 069 in 1912 and £12 638 in 1913.

If the quantity of Italian alcohol *exported* under its various forms is not large, the amount *imported* is still less. Pure spirit in casks or barrels amounted in 1911 to £1 155, in 1912 to £1 103 and in 1913 to £1 114. *Sweetened spirit* (in casks or bottles) was imported to the value of £29 821 in 1911, £31 692 in 1912, and £29 019 in 1913. *Cognac* (in casks, barrels and bottles) was acquired from abroad to the value of £18 226 in 1911, £25 820 in 1912, and £18 674 in 1913. Thus the total of the Italian products exported exceeds that of the imports, and might be considerably increased if the eastern markets could be opened up for sweetened and aromatised spirits (mastica) and a sale found in the United States for bitters, etc.

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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

1 – **Agricultural Resources of the Zanzibar Protectorate.** — Mc Clellan, F. (Director of Agriculture, Zanzibar) in *Bulletin of the Imperial Institute*, Vol. XI No. 3, pp. 407-429. London, July-September, 1914.

Position and Geographical Formation. — The island of Zanzibar 46 miles long and 20 miles broad, while the island of Pemba is abou 40 miles long, with an extreme breadth of 16 miles.

Geologically, Zanzibar is composed of :

1. Hard coral limestone.
2. White or yellow chalky deposits.
3. Sand.
4. Red earth.
5. Sandstone, found occasionally.

The red earth is formed by the disintegration of the coral rock and th chalky deposits have probably a similar origin.

The land on the west of the island rises in a series of hills to a centra plateau which passes through the centre of the island from north to sout and nowhere exceeds 450 feet. — The coast lands of the east and sout of the island consist largely of hard coral rock. The soil on the platea is a red or yellow marl.

Where not exposed to the wind, the red marl is the soil on whic clove trees do best. Pockets of red or black earth are often present an in such pockets the natives grow their cereals, and even sugarcan Formerly chillies were largely grown on such soil.

Pemba in many features resembles Zanzibar, but the proportion o land suitable for cultivation is much larger than in Zanzibar and th clove-tree plantations are heavier bearers, age for age.

Climate. — Between 1908 and 1913 the amount of rainfall in Zanzibar ranged from 50 inches (127 cm.) in 1910 to 85.14 (216 cm.) in 1909, and in Pemba from 57.91 in. (147 cm.) in 1912 to 83.40 (212 cm.) in 1911. The number of rainy days in the year is about 150.

The rainy seasons are well defined. The heavy rains occur in April and May previous to the setting in of the south-west monsoon. The light rains occur in November and December before the north-east monsoon. Some lighter rains, eagerly looked for by the small agriculturist, occur in July. The planting season for the clove tree and coconut tree is during the light rains occurring just previous to the heavy rains.

During the last five years (1909-13) the average maximum temperature in Zanzibar was 84.7° F. (29.3° C.) and the average minimum 76.3°. F. (23.5° C.). In Pemba the figures were respectively 81.4 and 69.8°. F. (27.6 and 21° C.).

Area. — The total area of Zanzibar may be taken as 400 000 acres, of which a large proportion is coral outcrop covered with low bush or grass. The area of Pemba is about 245 000 acres.

Land tenure and value. — Although the custom is no longer universal, plantations are still generally sold at so much a clove or coconut tree, small allowances being made for fruit trees and none being made for the actual land, whether planted or unplanted.

In plantations in fairly good conditions of cultivation and health the clove trees are valued from 6*s* 8*d* to 12*s* (Rs. 5 to 9) and coconut trees from 6*s* 8*d* to 8*s* 8*d* (Rs. 5 to 6 ½).

Ninety-eight clove trees or forty-eight coconut trees may be reckoned to the acre.

Crops. — Cloves were introduced about 1818, a few seeds being brought from Réunion. By 1860 there was an annual output of 200 000 frazilas (700 000 lb.) of cloves. In 1872 a hurricane practically destroyed the plantations in Zanzibar. They were at once replanted and therefore date from that year, whilst many of those in Pemba are 80 to 90 years old. The average yearly production during the period from July 1, 1904, to June 30, 1913, was 460 603 frazilas (16 121 105 lb.) ranging from a minimum of 135 386 frazilas in 1912-13 to a maximum of 798 660 in 1911-12. The production of Pemba and Zanzibar is over 90 per cent. of that of the whole world. Pemba has rather more than two-thirds of the total clove area, with about 42 000 acres, and there are in the two islands probably between five and six million trees in bearing. The age at which the clove tree yields most is probably between the thirtieth and fortieth year. A good crop is obtained once every three to five years, and the average yield of the Arab-owned plantations is about 3 ½ to 4lb. of dry cloves per tree per annum. A plantation in Pemba under efficient white management bears an average yearly crop of 8 lb. per tree, and in 1913 yielded 20 lb. per tree, the actual crop on trees in bearing being about 35 lb.

The cloves are gathered by hand, the pickers climbing the trees. The stems are separated from the heads by hand. In a mature plantation, 25 to 30 lb. of stems should accompany 100 lb. of cloves. One hundred

pounds of green cloves will yield about 47 ½ lb. of dry cloves. Drying is done in the sun.

The tree in Pemba and Zanzibar is comparatively free from disease. On its leaves a parasitic fungus, *Sphaerella vexans* Massee, has been found and damage has been observed which may be due to a root fungus; specimens are now in England under investigation.

Coconuts. — Systematically laid out plantations are rarely met with, though of late years planting has much extended; there are now probably 2 500 000 trees on an area of about 45 000 acres.

Under white supervision the tree yields 80 or 90 nuts per annum on good soil. In the inland plantations the yield is less.

Five varieties of nuts are recognized, three named according to their colour (white, black, and red) and two varieties of Pemba coconut of which one is used only for its milk while the other is used for both copra and milk.

Zanzibar copra is quoted at a lower price than some other copras, owing to the want of care in its preparation, especially if smoke-dried instead of sun-dried.

The mean annual output of copra from the two islands for the ten years ending 1912 was 16 000 000 lb. Most of the copra goes to Marseilles.

In addition to the nuts used for the production of copra, large numbers of them are used as food by the natives, and for the manufacture of a certain amount of coconut oil. In 1913 the value of the combined export of this oil and of sesamum oil was £2394 (Rs. 35 918). During the last ten years the values of this export ranged from £685 to £4495 (Rs. 10 280 to 67 423).

The coir fibre is entirely neglected. Coir matting and ropes made in the local jail and sent to the Imperial Institute for examination have been found to be of excellent quality.

Given proper cultivation and attention, the coconut tree in Zanzibar is fairly free from disease. The ravages of the rhinoceros beetle are slighter than those reported elsewhere. Bud-rot is noticeable only in neglected woods.

Rubber. — *Landolphia Kirkii* and *Mascarenhasia elastica* are indigenous, and *Hevea* and *Castilloa* thrive in the Islands. The rubber exported is obtained almost entirely from *Landolphia* The exports amounted to 2220 lb. in 1913.

Copal. — It is found in Zanzibar, but is not collected. Quantities of it are still shipped from the island but they come from German East Africa. The total export of copal was 104 159 lb. It is diminishing partly on account of the exhaustion of the fossil deposits and, to a greater extent, owing to the competition of New Zealand copal (Kauri resin).

Chillies. — Chillies were at one time cultivated to a considerable extent on the east coast of Zanzibar, but the industry has declined of late years. The exports, which in 1904 were 426 881 lb. worth £ 5837, fell in 1913 to 76 513 lb. worth £ 1042. The product is of excellent quality and superior to the Japanese.

Sugar. — It was formerly largely cultivated by the Arabs, but the industry has now decayed owing to the suppression of slavery.

Vanilla. — In 1897 the Government commenced the cultivation of vanilla with a view to encouraging the population to grow it; about 10 000 plants were established at Dunga. The plantations were successful, but as the Arabs and natives would not take it up the cultivation was abandoned in 1908.

Minor products. — On the Government Experimental Station at Dunga all the principal fibre-producing plants of the tropics have been grown. Much of the coral outcrop land of Zanzibar, which comprises about three-fifths of the island, is well adapted for Sisal hemp.

Kola also grows well and is easily raised. Rice, sugar, tobacco and maize are produced, but in quantities insufficient to meet local demands, and their importation has been gradually increasing during the last ten years. The following table indicates the value of some of the imports in the year 1913:

	£
Rice	152 682
Sugar	27 573
Tobacco	12 193
Timber	6 886
Cattle, goats and sheep	16 433

The natives grow cassava, hill and valley rice, maize, and some other cereals and pulse, besides sesamum, *Jatropha curcas*, castor oil, oil palm (which is indigenous), kapok, saponaria and all tropical and subtropical fruits, among which the oranges and pine-apples are distinguished for their fine flavour.

2 – **Recent Progress in the Agricultural Development of Sumatra.** — *L'Agronomie tropicale*, Year 6, Nos. 4 and 5-6, pp. 47-51 and 61-70. Uccle, 1914.

Sumatra has an area of 161 612 sq. miles and is divided along its whole length by a mountain range lying nearer to the west coast than to the east. The eastern portion is therefore more suited for plantations and has the advantage of a network of navigable rivers. The country is divided into six districts: West Coast, East Coast, Benkoelen, Lampongs, Palembang, and Ajeh. The guerrilla warfare which for half a century had rendered the northern part of the island unsafe was stopped five years ago, and the influx of capital and agricultural development are now possible. The jump in prices of rubber several years ago attracted considerable capital to Sumatra for the purchase of lands for planting *Hevea*, which has replaced many of the old coffee plantations.

Except in the district of Deli (East Coast), which long enjoyed prosperity on account of its famous tobacco and coffee, and in the district of Padang (West Coast), agriculture remained stationary until recent years, when plantations were established in all parts, especially near the rivers. The greatest difficulties in the development of the island are the

lack of means of communication and the scarcity of labour. The Govern ment, however, is actively making good the first deficiency and has, sinc 1905, introduced Javanese families onto prepared lands with a view t remedying the second drawback. A railway line already begun will con nect Tebing-Tinggi with Tandjong -Balei (East Coast); another line, whic is making rapid progress, will connect the port of Palembang with Telok Betong, and is the first portion of a main line which will run right acros the island. An irrigation scheme for the western part of the island i also under consideration, and will enable rice to be grown, particularl in the province of Benkoelen. There are still large areas unoccupied an consequently great possibilities for future development.

The following are the chief crops.

1. *Rubber.* — According to the report of Akers' Brazilian Commis sion, which visited the East Indies, Straits Settlements and Ceylon i 1911-12, the area planted with *Hevea* in Sumatra was estimated to hav increased from 6141 acres in 1906 to 22 000 acres in 1912, and the capita invested in these plantations was £10 430 000. The yield of rubber wa estimated at 3500 tons for 1913, at 8000 tons for 1914, and about 44 00 tons in 1919, excluding the yield of plantations which might be established after 1912. The plantations visited by the Commission were generally heathy and free from the attacks of termites, but here and there they show ed damage from storms. The rainfall varies considerably in the different localities, but is everywhere sufficient for rubber trees. Owing to the fer tility of the soil, *Hevea* succeeds even above altitudes of 1000 feet, but gener ally it is not planted above 130 feet. *Ficus elastica* is cultivated in the provinces of Benkoelen, Tapanoeli and Achin. In the Djambi district large quantities of *Hevea* seeds have been distributed to the natives. Euro pean plantations have been established in the districts of Riouw and Ta panoeli and in Atjeh, but chiefly throughout the East Coast district. In 1902 only about 400 acres had been planted with *Hevea* in this district, whilst at the end of 1912 there were no less than 197 533 acres. In this province the European plantations of *Ficus elastica* are estimated at 7000 to 10 000 acres, in addition to native plantings. The exports of rubber from the East Coast province were about 4 314 050 lbs., of which 3 283 450 lbs. were *Hevea* rubber. The nominal capital invested in these estates at the end of 1912 was £10 500 000, of which about half was English and about one-third Dutch.

2. *Tobacco.* — The cultivation of tobacco since its introduction in 1864 until 1912 has given a net revenue of 96 millions sterling. In 1912 the revenue was 3 millions sterling. Nine-tenths of this Sumatra tobacco goes to the Amsterdam markets. In the East Coast province tobacco was the only crop grown by Europeans until 1890, and it still remains the most important. There are 99 plantations belonging to 36 companies and two under private ownership. Several companies have abandoned tobacco and taken up *Hevea*. Excluding these plantations, the capital invested in tobacco is £4 100 000. The area under tobacco in 1912 was about 51 500 acres, and the yield of leaf was 281 125 bales of 172 lbs. each

of which 86 491 were sold in Amsterdam and Rotterdam at an average price of 2.29 florins per ½ kg. (3s 5*d* per lb.).

3. *Oil palm.* — This was cultivated to a small extent by the natives, and it is now being taken up by Europeans on a large scale with great success.

4. *Coconuts.* — Owing to the increasing demand for coconuts, the native plantations are being better cared for and considerable European plantations have been established. In the north of the province of Atjeh the "Sumatra Cocos Cultuur Maatschappij» Company with a capital of 7 ½ million florins (£ 625 000) possesses a factory at Aleh for the treatment of nuts collected from the natives, and is establishing others at Segli and Telok Seumaweh. The latter factory will be capable of dealing with 40 000 nuts per day, giving a daily output of 10 tons of coprah. The Company has obtained large areas of land for coconut cultivation and 12 500 acres in Langs have already been planted.

5. *Tea.* — The hilly districts, especially Simeloengoen in the centre of the island, are suitable for tea ; but in certain localities the lack of roads causes serious difficulties. Plantations have been established at Pematang, Siantar, etc. The one at Siantar, in the East Coast region, established in 1910-11, was the first to be planted in the province; others have since followed and 8 or 9 companies are in course of formation.

6. *Coffee.* — This crop is becoming less important in the East Coast province. Formerly *Hevea* was planted as an intercrop in the coffee states, but at present the position of the crops is reversed and coffee is only grown as an intercrop until the rubber trees come into bearing, when it is cut out. Formerly *Coffea liberica* was preferred, but since 1908 *C. robusta* has become more popular as an intercrop. In 1911 the exports of coffee were just under 3 million lbs., almost all Liberian; in 1912 only 552 990 lbs. were exported, of which 220 820 were *robusta*, 1 301 810 *liberica*, and 30 360 *arabica*. *Robusta* coffee is preferred by the planters, because it comes into bearing in three years, whilst Liberian coffee requires five or six years.

In the East Coast regions there are also European plantations of gambier and tapioca. The natives also grow pepper (of which the exports from this province were 3 689 060 lbs. in 1912), sago, rice and other crops.

— **Agricultural Education by Means of Railways, in Spain.** — *Landwirtschaftliche Maschinen und Geräte*, No. 20, p. 41. Artern, Province of Saxony, May 16, 1914.

AGRICULTURAL EDUCATION

Noteworthy efforts are now being made in Spain to utilize the railways as means of promoting agriculture. The Soria railway has provided most of its railway stations with small but practical agricultural museums which afford farmers, at all times, a good and rapid survey of all the most important technical agricultural novelties, besides which all kinds of information are given on manures, on the most suitable and economic agricultural machines, on live stock, etc. Further the railway management transmits to the Government the desirata of farmers in the matter of assistance for agricultural undertakings of general utility.

4 – **Research Work in 1913 at the Agricultural Experiment Station of the University of Wisconsin.** — RUSSELL, H. L. (Director) in *Agricultural Experiment Station of the University of Wisconsin, Bulletin* 240, pp. 18-40. Madison, Wisconsin, June 1914.

Sulphur in plant nutrition. — Confirming the results obtained last year, Professor HART and Mr. DRESCHER found that in soils containing about 0.04 per cent of sulphur trioxide, such high protein and sulphur plants as rape, radishes, turnip and clover responded in a marked degree to the application of a sulphate fertilizer. In the case of clover the addition of gypsum to a complete fertilizer supplying nitrogen, potash and phosphoric acid produced a 35 per cent increase in the dry matter of the crop.

Dr. PETERSON found that where no sulphate had been applied the plants contained absolutely no circulating sulphates. On the other hand the clover on soil where gypsum had been added contained an abundance of sulphates in the sap. Evidently in the first instance the growth of the clover was being limited because all the sulphates obtained by the plants from the soil had been built up into organic plant compounds.

Dr. PETERSON found also that such plants as June grass (*Poa pratensis*) and red clover contain volatile sulphur compounds, which are probably lost in the process of haymaking, and are partly responsible for the aroma of such materials.

Influence of soil bacteria on plant growth. — Prof. HOFFMAN found that when pure cultures of various kinds of soil bacteria were grown in the extracts from marsh soil which had been previously cropped to maize, oats or clover, in all cases the bacterial development was increased. The extracts from cropped loam and sandy soils, on the contrary, invariably retarded bacterial development. It was also found that the growth of different kinds of soil bacteria in a previously sterilized soil produced changes which in some cases decreased, and in others increased, the growth of plant seedlings when grown in extracts from these soils.

Bacterial digestion of fibre or cellulose. — Besides the legume bacteria, the free-living bacteria which are also able to fix nitrogen from the air require organic matter as a source of energy. Plant cellulose cannot be assimilated directly by these bacteria, but only when acted upon by the cellulose-digesting organisms.

Mr. PRIMM has isolated these bacteria directly (*i. e.* without previous growth in enrichment cultures) from over 50 different sources. He has also isolated bacteria which digest cellulose actively at 149° F. (65° C.) and has kept them in pure cultures for a number of generations at this high temperature without the loss of their cellulose-digesting power.

Availability of phosphate to various crops. —Mr. TRUOG grew ten different kinds of plants with the sole source of phosphorus as acid phosphate, rock phosphate, precipitated calcium phosphate, aluminium phosphate, iron phosphate (both ferric and ferrous), magnesium phosphate or manganese phosphate. The plants showed striking differences in their ability to secure and use phosphorus from these various sources.

Contrary to the general belief that aluminium and iron phosphate are

relatively unavailable to plants, nine of the ten plants tested made better growth on aluminium phosphate than on calcium phosphate and six better growth on iron (ferric) phosphate. The wide differences in the power of individual species to utilize phosphorus in various forms, show the inadequacy of chemical solvents in measuring the availability of different phosphates.

Grain and forage crops. — During the past year the Agronomy Department has continued the work in progress in breeding rye, the pedigree strains of which, are reported by Dr. MOORE to have duplicated the yields of last year, winter and spring wheat, and soy beans, which have shown themselves especially adapted to the sandy soils of Wisconsin, as they endure drought well, stand frost better than maize or field beans and are less sensitive to soil acidity than alfalfa or red clover. They are also an excellent first crop on newly cleared sandy lands, yields of a ton to a ton and a half of hay per acre having been secured. The pedigree strains of Wisconsin Early Black variety, which, on sandy soil in upper Wisconsin, mature in from 90 to 105 days, gave an average yield of 15.4 bushels per acre at the Spooner station during the three years 1911-13. In the past season, with abundant rainfall, yields as high as 27.6 bushels per acre were secured. Other breeding work dealt with clover and peas.

Animal husbandry. — Silage compared with soiling crops for summer feed. — During the last three summers the dairy herd of the Animal Husbandry Department was divided into two lots, uniform in production and weight; in addition to pasture and a limited allowance of hay and grain, one lot was fed maize silage throughout the season and the other a succession of soiling crops, such as red clover, peas and oats, oats mixed with peas and dent corn, and green (sweet or dent) maize. The production of milk and butterfat was practically the same in both lots. Silaged maize, however, can be produced at less expense than the soiling crops, so that it is recommended especially for large herds, at least up to the time when the maize crop reaches the milk stage.

Feeding draft foals. — During the winters 1911-12 and 1912-13 Prof. FULLER conducted feeding trials with 11 pure-bred draft foals to study their development and cost of feed. They were fed *ad lib.* a mixture of 60 per cent ground oats, 15 per cent maize meal, 10 per cent bran, 15 per cent alfalfa hay, consuming on the average 16.5 lb. per day. It was found that on this ration the foals could be made to reach weights of 1000 and 1200 lb. at the age of one year. During the feeding periods, which ranged from 140 to 233 days the foals made gains averaging 2.1 lb. per day at an average daily cost of 18 cents. The estimated average cost of feed for the foals for the entire first year was $ 51.66, Such a system of feeding, it is believed, will pay for pure-bred or good grade foals.

Mineral requirements of farm animals. — Previous work had already shown that the lime requirement for maintaining the mature animal, not pregnant, is relatively small, being about 0.3 gm. per 100 lb. body-weight in hogs, and from 0.4 to 0.5 gm. in goats.

During the past year a dry pregnant milch-goat was fed rations low in lime during the entire gestation period, at the end of which she gave birth to twin five-pound kids of normal weight and vigour. During this period of gestation, the goat lost about 20 per cent of the total amount of lime contained in her body, including the amount stored in the bodies of the offspring, although without any outward or apparent ill effects.

These results are similar to those of a previous trial, in which 25 per cent of the entire amount of lime contained in a cow's body was withdrawn in an effort to produce milk containing the normal amount of lime.

Including the requirements for foetus building and for milk production, the 1000-pound pregnant cow giving 25 lb. of milk will require from 50 to 60 gms. of lime per day. Such requirements are usually met by the ordinary farm roughages, such as hay and maize stover, but with straw in any large quantity as a part of the ration, the lime supply would be deficient.

Value of fat from various sources. — Professor Mc COLLUM has been engaged in a study of the influence of the composition and quantity of the inorganic matter in the ration on the growth of animals. He employed rations compounded of casein, carbohydrates and salt mixtures made up of pure chemicals, and also the same rations in which a part of the carbohydrates was replaced by lard. On certain mixtures he was able to obtain, with rats, practically normal growth for periods varying from 70 to 120 days, but after that time little or no increase in body-weight could be produced with such rations. The animals in many cases, however. maintained their weight and a well nourished appearance for weeks after growth had ceased, and resumed growth when placed on a ration of certain naturally occurring food stuffs.

After numerous attempts to prevent the suspension of growth by nice adjustments between the ingredients of the diet, it was supposed that some organic compound might be lacking which was indispensable for further growth and experiments were made to ascertain if these compounds were those contained in the ether extracts of the food, and known as lecithins and cholesterins. DR Mc COLLUM accordingly tried adding ether extracts from different sources to the diets of these rats. When the fat from egg yolk or butter was added to a ration, growth was immediately resumed. When olive oil was added, no such effect was produced. These studies show that the fat from substances designed by nature for the nourishment of the young, such as eggs or milk fat, may differ in food value from those of other origin.

Effect of poisons on the germ cells of the male. — In studying this problem, Prof. COLE treated male rabbits with lead and with alcohol and studied their offspring in comparison with those from normal males. The experiments are yet in an early stage, but it appears that alcoholic poisoning of the male lessens his efficiency as a sire, the alcohol apparently having some effect on the vitality of his spermatozoa. The males treated with lead have produced as many or more offspring than the normal fathers, but their young have averaged smaller in size and of lowered vitality, so that larger numbers of them die off at an early age.

Vaccine treatment of chicken pox in fowls. — Professors HADLEY, BEACH and HALPIN have studied the comparatively new vaccine treatment against chicken pox first suggested by MANTEUFEL.

Vaccines were prepared by grinding diseased tissues and subjecting them to a temperature of 131° F. (55° C.) for one hour. The injection of these vaccines was found to be highly beneficial both as prevention and as cure, and this notwithstanding the considerable variation in the natural susceptibility of fowls to artificial inoculation.

Contagious abortion. — The Veterinary Department has instituted experiments on vaccination against contagious abortion, using for vaccine both killed and living cultures of the causal organism, *Bacillus abortus*. In some cases animals treated with vaccines and subsequently injected with doses of living cultures large enough to produce abortion in control heifers have delivered full-time healthy calves. The Legislature, recognizing the great importance of this question, has appropriated $5000 for the present biennium for the further study of these problems.

Pasteurized milk cheese. — Professor SAMMIS devised a process for making cheddar cheese with pasteurized milk. This method was experimented for three years in cooperation with the U. S. Department of Agriculture. In the previous *Annual Report of the Wisconsin Agricultural Experiment Station* (1) it was stated that the pasteurized cheese varied less in quality and was better than cheese made from the same milk unpasteurized. Moreover the yield of pasteurized milk cheese was always greater by about 5 per cent. In 1913 the manufacture of cheese from pasteurized milk was tested in commercial factories and there also the advantages of the system were confirmed. The extra cost of making pasteurized cheese was rather less than $2.25 per 1000 lb., which would be fully offset by a gain of only 1 ½ per cent in yield.

5– **Recent Investigations at the Imperial Institute.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 3, pp. 337-374. London, July-September 1914.

I. ECONOMIC PRODUCTS FROM THE ZANZIBAR PROTECTORATE. — The specimens of leguminous seeds, millets and oil seeds dealt with represent the ordinary produce as grown by the natives.

Cloves. — The cloves (buds) contained from 17.4 to 19.2 per cent of essential oil; the stems (stalks of the inflorescence from which the buds had been removed) from 5.9 to 6.3 per cent. The yields of oil are satisfactory, as the averages are respectively 18 and 6 per cent. The essential oil contained from 84 to 90 per cent. of eugenol. It was observed that the odour of the clove oils was better the higher the yield of oil from the samples, and that the best sample of cloves consisted of those picked just before the buds turn pink, or about 8-10 days before the usual time.

(1) See *B.* July 1913, No. 867. (*Ed.*)

Smaller seeded cereals. — The seeds gave the following results on analysis:

	Eleusine coracana	*Setaria* sp.	*Pennisetum typhoideum*	*Sorghum vulgare* (red)
Water	10.3	9.47	10.60	10.0
Crude proteins	5.4	10.20	12.47	11.2
Fat	1.5	4.31	5.00	2.8
Starch, etc.	76.9	65.11	67.13	72.1
Fibre	3.4	7.83	2.8	1.8
Ash	2.5	3.08	2.0	2.1
Nutrient ratio	1 : 14.9	1 : 7.3	1 : 6.3	1 : 7
Food units	94	101.4	110.8	107

The seeds contained no cyanogenetic glucosides.

Leguminous seeds. — Samples of *Vigna catjang, Phaseolus mungo, Dolichos lablab, Cajanus indicus* and *Voandzeia subterranea,* were examined. The latter contained: moisture 7.8, crude proteins 19.1, fat 6.5, starch etc. 58.9, fibre 4.2, ash 3.5 per cent. Its nutrient ratio was 1 : 3.9 and its food units 123.

The seeds contained no cyanogenetic glucosides.

Oil seeds. — The results of analyses are summarized in the following table:

Seeds	Husk per cent.	Kernels per cent.	Oil per cent. in kernels
Para rubber	56	44	45
White sesamum	—	—	53.8
Black sesamum	—	—	49.1
Kapok (*Eriodendron anfractuosum*) moisture: 12.7 %	—	—	21
Jatropha Curcas	33.7	66.3	51.2
Ground nuts (*Arachis hypogaea*)	28	72	52
Moringa pterygosperma	39	61	28.6
Oil-palm nuts	61	39	52.7

On examindtion Para rubber and kapok oils gave the following results

	Hevea brasiliensis *	*Eriodendron anfractuosum*
	seeds	seeds
Acid value	42.7	26.0
Saponification value	198.8	194.2
Iodine value, per cent.	136.0	101.5

* The results previously recorded at the Imperial Institute were as follows: Acid value 10.7 to 29.9; saponification value 185.6 to 195.7 and iodine value 121.2 to 136.2.

It is doubtful whether the residual cake of *Moringa pterygosperma* can be used as a feeding-stuff, because it has been found to contain traces of an alkaloid and also a large quantity of non-albuminoid nitrogenous matter.

From Zanzibar, seeds of *Cesalpinia bonducella* were also sent. These seeds are the "Haba de San Antonio" of the Mexican Pharmacopoeia; they are used as a febrifuge.

Seaweed. — The sample consisted of dry papery fronds and contained: moisture 20.72 per cent, nitrogen 0.76, and ash, containing much sand, 30.26. The ash was submitted to analysis and found to contain CaO 15.86, K_2O 1.82 and P_2O_5. 0.36 per cent. This seaweed from Zanzibar was thus much poorer in the above substances than certain seaweeds of the genera *Fucus* and *Laminaria.*

II. Wheat from the Sudan. — Wheat growing in the Sudan has increased steadily during recent years (30 302 acres in 1912 against 20 429 ac. in 1910), but the area devoted to this crop is still very small compared with that under dura (1 232 145 acres in 1912). Wheat is grown almost entirely under irrigation, either artificial or flood. At present wheat is cultivated chiefly in the Dongola and Berber provinces. At present the production of wheat in the Sudan does not meet local demands. Thus in 1913, 3 807 218 lbs. of wheat worth £16 062, and 18 230 983 lb. of flour worth £89 983 were imported.

The samples that were examined consisted of more than one variety of wheat; one was a mixture of hard and mellow wheat, and they all yielded a flour that was not quite white.

III. Peas and Beans from Burma. — The *Phaseolus lunatus* beans shipped from Burma to Europe are of two kinds, known as red and white Rangoon beans. The former are regarded with suspicion as they yield minute and usually harmless amounts of prussic acid and they realise comparatively small prices in the markets (about £6 per ton), whilst white Madagascar beans (which are used for human food) fetch over £24 per ton. In view of these facts the Imperial Institute suggested to the Department of Agriculture in Burma to encourage the natives to cultivate white Madagascar beans. It was also suggested that experiments be made in the cultivation of "Victoria" and "Green" peas. The Mandalay Agricultural Station, Burma, tried the above seeds, and the results were encouraging. The peas however revealed no feature of special value over those already grown in the country.

Samples of the pulse grown were submitted to chemical examination and the percentage of prussic acid found in them are as follows: Peas, *nil*; Madagascar beans, 0.005; *Phaseolus lunatus*, from 0.01 to 0.05 (the maximum being in red beans, the minimum in the uniformly dark ones).

IV. Timbers from Africa and from British Guiana. — Plantations of teak (*Tectona grandis* L.) have been made in a number of the forest reserves in the Southern Provinces, Nigeria. Samples of the wood from a specimen tree, twenty-six years old, forwarded to the Imperial Institute for examination, showed the wood to be very like East Indian wood in colour, texture and markings; it also works similarly. It is somewhat inferior to Burma teak in transverse strength, but about equal in resistance to compression. It is also slightly lighter, being 45 lb. per cubic foot.

Mashuna wood from Rhodesia, which is stated to be resistant to the attacks of white ants, was also received. It weighs 63 ½ lb. per cubic foot. It makes beautiful turned objects. It should be very useful for purposes where it can be used in large pieces and not in thin boards, as these would split easily.

" Mukokoto " (*Pterygota* sp.) timber, from Uganda, weighs 38 lb. per cubic foot; it splits in a brittle manner, saws easily, but tears badly in planing.

" Duka " (*Tapiria* sp.) wood, from British Guiana, has given doubtful results as a possible substitute for cedar wood.

V. — RUBBER FROM THE GOLD COAST AND PAPUA. — The cultivation of *Hevea brasiliensis* has been undertaken very successfully at the Government Agricultural Stations in the Gold Coast, notably at Aburi and Tarquah, and by European planters and natives. At Aburi in 1912 the average yield per tree was 2 lb. 10 ½ oz. of dry rubber from 158 vertical parallel tappings and 2 lb. 13 oz. from 156 half-spiral tappings. At Tarquah the average yield of dry rubber per tree was 2lb.3oz. of dry rubber, and from trees eight years old 3lb.12oz.. The rubber is of good quality; it contains 94.1 per cent. of rubber, 2.9 per cent resin, 2.7 per cent protein and 0.3 per cent ash.

Hevea brasiliensis at Sierra Leone is still in the experimental stage. The samples examined were of good quality.

A sample of *Funtumia elastica* rubber from the Gold Coast, prepared by coagulation by means of the addition of 1 per cent of formalin to the latex, showed good physical properties, though it contained rather high percentages of resin and protein.

Two samples of *Ceara* rubber from Papua were also examined and found to be of satisfactory composition.

CROPS AND CULTIVATION.

6 – **The Decomposition Products of Aluminiferous Silicate Rocks, especially the Laterite of Madagascar.** — LACROIX, A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 18, pp. 618-622. Paris, November 3, 1914.

A comparison of the manner of decomposition of aluminiferous silicate rocks in Madagascar, Guinea, or generally in West Africa, furnishes additional proof of the complexity of the laterite problem (1). According to the writer the red soils of Madagascar are improperly called "laterites"; they are nothing more than " lateritic clays" or simple clays. The true laterites (which contain at least 90 per cent hydrates of iron and alumina, compared with 50 to 90 per cent in the " silicated laterites ", 50 per cent in the " lateritic clays " and a very small percentage in ordinary clays) are

(1) See *B.* July 1913, No. 777. (*Ed.*).

only the decomposition products of the diabases, gabbros (in this case mostly silicated laterites) and especially the rocks of a light and often bright white colour resulting from the transformation of syenites, granites, etc. The red colour which so many observers have considered specific for laterites, is not in general a reliable indication.

7 – **A Study of Some Water Tables at Giza.** — BALLS, W. L., in *The Cairo Scientific Journal*, Vol. VIII, No. 92, pp. 102-111. Cairo, May 1914.

Seventeen tube wells were sunk on an area of about thirty acres at Giza (Egypt), and their water level was measured daily for four months. The records show that the water table is singularly sensitive to surrounding influences and provide a definite proof that irrigation has raised the level of the natural water table in Egypt, being thus one of the contributing causes in the deterioration of the cotton crop.

8 – **The Variation of the Fertility and Productivity of the Soil under the Influence of Natural Conditions and Dry Air Storage.** — GHEDROIZ, K., in *Selskoie Khosiastvo i Lessovodstvo* (*Agriculture and Forestry*), Year 47, No. 245, pp. 630-633. Petrograd, August 1, 1914.

The experiments here described were conducted in zinc vessels each containing 4.47 kg. (9.85 lbs.) of soil. The manure consisted of nitrate of lime containing 0.75 gm. nitrogen, monosodium phosphate containing 0.5 gm. P_2O_5, and sulphate of potash equivalent to 0.5 gm. K_2O. The experiment included : *a*) two pots without manure, *b*) two with complete manure, *c*) two like *b*, less the nitrogen, *d*) two like *b*, less the phosphoric acid.

The soil which had been stored in dry air since 1903 gave the results shown in Table I.

TABLE I. — *Total crop obtained from* 1903 *soil stored dry* (*in gms*).

No. of years of storage	Without manure.	Complete manure.	Complete manure plus lime.	Complete manure less nitrogen.	Complete manure less phosphate.	Complete manure less potash.
Oats :						
1	19	118.1	109.5	21.6	19.4	120.4
2	26.6	75	—	20.9	30.3	74.4
3	26.2	83.1	—	28.0	46.9	—
4	34.3	93.5	—	37.6	52.9	—
5	25	102.8	—	32.2	42.0	—
6	41.6	107	—	58.1	39.8	104.3
Flax :						
1	14.3	42.6	48.5	16.1	15.2	42.7
2	23.5	57.5	—	24.4	29.6	54.8
3	22.6	59.3	—	22.0	29.3	—
4	33.8	91.7	—	34.8	43.8	—
5	24.9	73.1	—	32.2	35.1	—
6	19.3	71.6	—	41.6	19.4	70

These results show a gradual increase in the case of oats without manure except in 1908. The same effect also occurred in the pots without nitrogen and without phosphate. With the complete manure the greatest yield was obtained in the first year ; there was then a considerable decrease in the second year, followed by a gradual increase, though the yield of the first year was never reached. In the case of flax with a complete manure the harvest increases regularly during the four years after the first year, then remains almost constant. With the other series the changes correspond to those of the oats.

As a check on the above experiments, which were made in various years with 1903 soil, a series was carried out in which soils collected in various years were all tested in the same year (1908) ; the results on the effect of storage obtained in this way are shown in Table II.

TABLE II. — *Total crop obtained in* 1908 *from soils stored dry* (*in gms*).

No. of years of storage	Complete manure.	Without manure.	Complete manure less nitrogen.	Complete manure less phosphate.
Oats :				
0	83.5	10.3	13.5	11
1	83.9	17.8	32.0	19
3	90.9	24.6	23.6	35.4
5	102.8	25.0	32.2	42
Flax :				
0	54.4	10.4	14.4	11.4
1	54.5	17.3	26.0	18.0
3	59.4	20.8	22.1	27.7
5	73.1	24.9	32.2	35.1

These experiments and many others carried out by the writer during a period of years, show that the yield is always in direct relation with the length of storage of the soil.

Chemical analysis shows a slight increase in the percentage of phosphoric acid soluble in 2 per cent. citric acid and in acetic acid. In 1904 the citric acid soluble P_2O_5 was 0.0078 per cent and in 1909 the same soil gave 0.0096 per cent. The percentage of phosphoric acid in the oats and flax was also increased with the duration of storage of the soil. Thus the yield of oats from the soil stored since 1903 and to which complete manure had been added was 19.4 gms. containing 0.169 per cent of phosphoric acid in 1904, whilst in 1909 the yield had increased to 39.8 gms. containing 0.271 per cent. of phosphoric acid. Similar results were obtained in the case of flax, *viz.* a direct relation between the storage of the soil and the increase in yield and in phosphoric acid content.

Chemical analysis showed similar results with respect to nitrogen. In 1904 the yield of oats from soil stored since 1903 and with complete manures, less nitrogen, was 21.6 gms., and the percentage of nitrogen 0.611. In 1909, the harvest was 58.1 gms, and the percentage of nitrogen 0.812. In the case of flax the percentage of nitrogen was 0.708 in 1904 and 1.09 in 1909.

These results lead to the conclusion that storing the soil in dry air increases its productivity in proportion to the period of storage and also increases in a corresponding degree the percentage of phosphoric acid and nitrogen in the crop.

9 – **Investigations into the Nitrogen Metabolism of Soil.** — GREEN, H. H. (Laboratorium für Bakteriologie am landwirtschaftlichen Institut der Universität Leipzig) in *Centralblatt für Bakteriologie, Abt. II*, Vol. XXXXI, No. 18 23, pp. 577-608. Jena, July 22, 1914. (Paper written in English).

A series of field plots were treated with various nitrogenous manures: *viz*, nitrate of soda, sulphate of ammonia, cyanamide, and blood, flesh and horn meals. They were sampled at approximately monthly intervals throughout the twelve months August 1912 to August 1913 and the samples were tested to determine: *a*) ammonification in the cyanamide and organic manure plots ; *b*) nitrification in the ammonium sulphate plots; *c*) fixation of atmospheric nitrogen. The bacterial activity of the soil in respect to ammonification of the organic manures showed a rise from August to October, a tendency to fall or remain constant in November, and a rise to a maximum in December followed by a minimum in February and a lower maximum in April; from April to July there was a slight fall which was probably continued to a summer minimum in August. Tests carried out on the decomposition of cyanamide showed irregular results owing to the use of defective laboratory methods. The variation in bacterial activity in respect to nitrification was similar to that for ammonification except that the spring maximum occured in March and the decline to a summer minimum commenced in April. The smallness of the actual variation in ammonification and nitrification, and the unexpected December maximum are attributed to the exceptionally mild character of the winter. As to the cause of seasonal variation in bacterial activity, it is believed that the larger organisms of the protozoa type play an important part. With regard to the fixation of atmospheric nitrogen, fixation in a 1 per cent mannite solution was low with the soil samples of August and September 1912; in subsequent months a fairly constant fixation of about 10 mgms. of nitrogen per gram of mannite was recorded, except with the soil samples taken after ploughing and disturbance of the sampling layer. Nitrogen fixation through *Azotobacter* was observed in July and August of 1913, though no perceptible growth of *Azotobacter* had occured in mannite solution with soil sampled in August 1912 or in any other summer of the preceding ten years.

The above ammonification, nitrification and cyanamide decomposition tests were not only carried out by the usual solution methods, but also by using soil itself as a medium of growth in order to compare the results obtained by the two methods. In the nitrification tests, the solution

method gave much clearer indications of seasonal variation, the failure of soil tests in this respect being attributed to the low proportion of chalk in the soil under investigation. The seasonal variation in ammonification was shown rather more clearly in soil tests, but the differences were too small to serve as a basis for comparison of the two methods. Otherwise parallel results were obtained by both methods.

In comparing the biological data obtained in the laboratory investigations with those obtained in the field by weighing the crops on the variously manured plots, it would appear that the laboratory tests may be of considerable value in affording information as to the decomposition processes naturally occurring in soils.

The bacterial activity of the soil and the crop returns were also compared on the two halves of the experimental area, one of which had been broken up in summer and ploughed in autumn and the other left untouched till spring. No difference in soil activity could be detected between the two halves, although the crop returns showed a decided superiority in favour of autumn cultivation, which is entirely confirmed by local farming traditions.

10 – **The Action Between Clay Filters and Certain Salt Solutions.** — HICKS, W. B. (U. S. Geological Survey) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 10, pp. 829-831. Easton, Pa., October 1914.

When soils and clays are extracted with water, colloidal suspensions are obtained which readily pass through the best grades of filter paper but yield perfectly clear filtrates when filtered through Pasteur, Chamberland or other close-grained porcelain filters; in many cases, however, this treatment changes the composition of the solution. The present investigation was undertaken in order to repeat and extend some of Briggs' work on the action between close-grained porcelain filters and salt solutions. After examining the composition of the filters and showing that the solvent effect of water on them is negligible, salt solutions were filtered, and the filtrates were analysed to determine changes in concentration with regard to the acid radicles. No change in the boric acid content of N/10 sodium borate solutions occurred and only very slight changes (0.2 per cent.) in N/10 solutions of sodium and potassium sulphate. With sodium and potassium chloride solutions the loss in concentration amounted to 0.3 per cent. in N/10 solutions and 0.5 per cent. in N/100 solutions. No calcium, aluminium or silica was found in these filtrates, indicating that the above salt solutions have very little solvent action on the filters. With N/10 and N/1000 sodium and potassium carbonate there was an actual increase in the total solids of the filtrate (determined as chlorides), amounting to 0.5 per cent. in N/10 solutions and 8 per cent. in N/1000 solutions, while silica was extracted from the filter in quantities almost equivalent to this gain; the alkalinity also showed a slight diminution with N/10 solution and about 8 per cent. decrease in N/1000 solution, indicating a direct absorption of the salt or of the base.

In a second series of experiments a direct determination of the quantity of salts retained by the filters was made; excess of 2 per cent. and N/100

solutions of potassium chloride and of N/10 solution of potassium carbonate were first passed through the filters, and the latter were then washed with water till the washings were free from the salt in question ; finally the filters were treated with successive fractions of N/5 ammonium chloride to dissolve out the residue. The results show that a small but appreciable quantity of potassium is persistently retained by the filters even after long washing with water; this was largely but not completely removed by extraction with 100 cc. of N/5 ammonium chloride, a small and uniform quantity being extracted by succeeding fractions. Practically the same quantities of potassium were retained by the filters from all solutions, indicating that the amount retained is independent of the concentration and character of the solution; moreover, the ammonia similarly retained from ammonium salts corresponded closely to that found for potassium salts. It thus appears that the filters become " salted " to a small degree and contaminate a succeeding solution filtered through them. At the same time the total residue extracted by ammonium chloride is much greater than the amount of potassium retained by the filter, indicating that ammonium chloride exerts an appreciable solvent action on the filters.

11 – **An Improvement in the Electrical Method of Determining Salt in Soil.** — BEAM, W., and FREAK, G. A., in *The Cairo Scientific Journal*, Vol. VIII, No. 93, pp. 130-133. Cairo, June 1914.

In determining the salt content of a soil impregnated with soluble salts by means of the electrical conductivity of its soil solution, it is important to distinguish between calcium sulphate and other salts, as the former is not only harmless but actually neutralizes the effect of the other salts. This distinction may be readily and satisfactorily effected by employing dilute alcohol (40 per cent. by volume) in the place of water for the extraction of the salt, and by comparison with a table of resistance of the salt in the same solvent. If an ordinary water extraction estimation be made simultaneously, then the percentage of calcium sulphate in the total salts may be calculated. Examples are given from the soils of the Reseach Farm at Khartoum North.

12 – **The Determination of Soil Carbonates.** — HUTCHINSON, H. B., and MAC LENNAN, K. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 323-827. Cambridge, September 1914.

In order to meet the increasing necessity for an easy and accurate method of estimating the amount of carbonate in soils, the writers have evolved a simple apparatus which is described in the above paper. The soil is treated with 2 per cent. hydrochloric acid and the carbon dioxide absorbed by N/10 sodium hydroxide ; excess of barium chloride is then added to the sodium hydroxide solution to remove carbonates from solution, and the free alkali is titrated against standard acid, using phenolphthalein as indicator.

13 – **The Estimation of the Lime Requirement of Soils by Means of the Hydroxide of the Alkaline Earths.** — MOULTON, C. R., and TROWBRIDGE, P. F. (University of Missouri, Columbia) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 10, pp. 835-837. Easton, Pa., October 1914.

The Bizzell and Lyon method of estimating the lime requirement of soil was examined with regard to its reliability under various circumstances. This method consists in boiling a soil with an excess of N/10 barium hydroxide and measuring the excess by means of subsequent distillation with ammonium chloride, the ammonia being caught in N/10 acid. The investigation showed that the method is unreliable, as the amount of barium hydroxide absorbed by the soil increases with the amount used and in the subsequent distillation this hydroxide is gradually set free again if the operation is continued long enough.

OPENING UP LAND FOR CULTIVATION

14 – **The Cultivation of Desert Land.** — ULPIANI, C. (Royal Agricultural College, Portici) in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIII, pp. 637-673. Modena, 1914.

Continuing his preceding article on the lateritisation of soils under arid climates (1) and taking into account recent agricultural research in Italian Libya and the practice of dry-farming, the writer discusses the following questions of practical importance: is it possible 1) to oppose the extension of desert lands? 2) to limit their area? 3) to reduce them to their prehistoric natural limits? 4) or even to remove from the earth this degeneration of the soil which dries up all forms of life, whether vegetable or animal? It is concluded that individual initiative will never be able to combine for the work of controlling desert land. The interested States should organise and coordinate this movement by the introduction of model farms to demonstrate the possibilities of the profitable cultivation of certain xero-halophytic plants in the arid zone. It is particularly desirable that the cultivators should be assured of the ready sale of their products by means of protective legislation and if necessary by monopolising the trade in them. Possibly even cooperative action among the different States might be desirable.

The writer considers it necessary to develop a collective world conscience in favour of the control of deserts, which are a permanent menace to civilisation and life. Caetani (*Studi di Storia Orientale*, Milan, 1911) has shown that all the series of human migrations from prehistoric and historic times up to the latest invasions of Mongols and Turks, should be regarded as the effect of the uninterrupted extension of deserts. In connection with this subject, it should be recalled that Glinka has shown (" On the former processes of soil decomposition in the Amur basin ". — *La Pédologie*, 1911) that during the Tertiary period the process of lateritisation extended to Siberia.

An institute of international character such as the International Institute of Agricultre would be be able to contribute effectively to the development of this collective conscience. At the present time the small farm which should provide the owner with all the necessities of life can no longer

(1) See *B.* Dec. 1912. No. 1609. (*Ed.*).

exist in competition with the large farm worked on an industrial scale and adopting the crops really adapted to the soil and climate so as to obtain the maximum yield. The International Institute, beginning with geographical botany and agro-geological maps, should study the distribution of crops with a view to attaining a maximum yield by a minimum of effort, by avoiding all useless competition. The sub-desertic zones, on account of their luminosity and aridity, should be given up to the cultivation of xero-halophilous plants suitable for use in certain industries, such as those of alcohol, paper and tannic acid, which should also be protected and encouraged. With regard to alcohol it should not be forgotten that in the present feverish consumption of petrol and coal all existing supplies of fuel are being worked incessantly without consideration for their exhaustion or the possibility of finding substitutes which would serve to postpone the coming of a crisis in the world's supply of energy. With regard to the paper industry, to supply which our forests are being depleted, it is desirable that an international entente should be establish with a view to insisting on a world-wide respect for forest trees, which are so useful in damp regions for fixing the soil and preventing floods, and also with a view to encouraging by every possible means the re-clothing of steppes by means of esparto, diss (*Ampelodesmos tenax*) and analogous plants. With regard to the tannic acid industry, instead of destroying the chestnut woods of France and Italy, it could be supplied by cultivating *Rhus Oxyacantha* and perhaps sumac in arid regions.

At the present time the control of deserts should occupy a considerable amount of attention. It is a problem affecting all continents equally, either on account of the serious menace of the encroaching zone, or because once the desert land is conquered it offers a large area for expansion. When vegetation has been definitely established on the arid steppes it will be possible to utilise the sun's energy, check the violence of the wind, diminish the drought, reduce the great daily range of temperature and prevent the continual formation of dust.

15 -- **Irrigation Works in Italy.** — LUIGGI LUIGI, President of the Italian Society of Civil Engineers (Abstract from a paper read before the British Association in Australia 1914) in *Journal of the Royal Society of Arts*, Vol. LXII, No 3228, pp. 940-943. London, October 2, 1914.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

It is only by means of irrigation that the most intensive systems of agriculture, such as the citrus groves of Sicily, the market gardens of Naples, the flower gardens of Liguria and the water meadows of Lombardy, are possible in Italy, where rainfall is scanty and irregular in certain areas and generally confined to the winter months, thus leaving six or seven months of the year with very little or none.

The methods of irrigation vary considerably; when only small quantities are required, as for orange groves and flower gardens, the water is generally raised from the subsoil either by means of water buckets, rotary pumps worked by animals (as in Southern Italy) or by small, but modern centrifugal pumps, worked by oil or electric motors, as in the Riviera

and many parts of the valley of the Po, where hydro-electric plants are very common.

The cost of the water raised electrically, especially during the day time, when the electric current is distributed at lower rates than at night — varies from 4½*d* to 11*d* per 1000 gallons. If raised by animals or by men its cost would be respectively 8 to 17 times higher.

This water is used in orange groves and gardens for the production of early vegetables and flowers, which realise such good prices in the markets of Central and Northern Europe as to justify the expenditure. The revenue of a good orange-grove varies from £36 to £54 per acre per annum. For irrigation on a large scale, *i. e.* for fairly large farms of some 50 to 100 acres in extent, where ordinary vegetables, fruit trees, vines, olives, etc., are cultivated, this price of water would be prohibitive, and, besides, the quantity would be insufficient. Then, recourse is had to rainfall by storing it up in reservoirs. These vary from the modest cistern of some few hundred cubic metres capacity to large artificial lakes of many million cubic metres, formed in some valley of the Alps or Apennines by dams, built either of earth, rock-fill or masonry, the last being generally preferred.

There are already many large reservoirs, especially in Northern Italy, such as the Lagastrello, Brasimore, Gorzente, Devero, Adamello, etc., but the largest of all is now in construction in Sardinia, across the river Tirso. The dam, of masonry, is 179 feet high and is of gravity section. It will impound 12 250 million cubic feet of water, sufficient to irrigate from 50 000 to 80 000 acres of land capable of being cultivated for early vegetables, fruits, oranges, olives, vines and such high-priced products.

Several other dams are to be built soon in Southern Italy, the most important being on the rivers Bradano,Sila, Simeto and Fortore. The Fortore dam will be 243 feet high and will impound 14 350 million cubic feet of water and irrigate about 100 000 acres.

The water from these artificial lakes is generally used first for motive power in hydro-electric installations, which in Northern Italy are very plentiful — and this helps much in lowering the price of the irrigating water — and afterwards it is distributed by means of canals to the different farms at the price of about ¼ *d* to ½ *d* per 1000 gallons or at the annual rate of from £1 10*s* to £2 10*s* per acre. These prices are still too high for ordinary irrigations, especially of meadows, and besides for very large extensions of land the quantity of water that can be impounded is always comparatively small. In this case water is obtained from rivers, generally fed by some natural lake, like the rivers Ticino, Adda Oglio, Mincio, or by glaciers, like the rivers Tanaro, Po, Dore, Orco Adige, etc.

The engineering works consist of a submersible dam of very substantial masonry, built across the river, and capable of raising the level of the water to that of the country to be irrigated ; of some controlling sluices at the canal head ; and of a main canal, with lateral distributing ditches, provided at their intake with some apparatus for measuring the water delivered.

Many of these canals date back to the Middle Ages. For instance, the " Naviglio Grande " was built in the twelfth century; it is about 50 miles long and has a capacity of 2 275 cubic feet per second and is also used for navigation, as are all the " Navigli " canals. In order of date come the " Muzza " with 2 500 cubic feet per second, the " Cremona " with 1 250 cubic feet and scores of smaller ones.

Of the modern canals, the most interesting, from an engineering point of view, are the Villoresi with a capacity of 1 540 cu. ft., the Marzano with 1 050 cu. ft., metres, the Veronese with 525 cu. ft., the Tagliamento with 612.5 cu. ft.

The largest and longest of all is the " Cavour " canal, with a capacity of 3 850 cubic feet per second and a development of fully 100 miles. It has been the means of transforming an almost barren region of 250 000 acres of sand and gravel into the most fertile rice fields and meadow-land of Italy. A still larger canal is about to be started, the " Emiliano ", with a capacity of 10 500 cubic feet, 120 miles long and estimated to cost 12 millions sterling.

In addition to capital, an irrigation scheme requires time and experience in adjusting the cultivation of the land to the new conditions. Under the best conditions it takes from twenty to thirty years — and sometimes even more — to dispose of all the water of a large canal. The " Villoresi " in a region where irrigation is pretty well developed, after forty years has not yet disposed of all its water. Consequently such expensive undertakings can only become possible with Government help, which in Italy amounts to a subsidy of 3 per cent per year for a period of 10 years on the capital spent in the construction of the main canal and its principal branches, 2 per cent per year for the following ten years and 1 per cent for another period of 10 years.

If the canal is so arranged as to help to control the flood waters of rivers, as when an impounding reservoir is also built, then a subsidy is granted of from 20 to 50 per cent of the expenditure.

For example, in the case of the Tirso canal and reservoir, estimated at about £800 000, the State pays £120 000 for the beneficial effect of the river to the State, and grants a yearly subsidy of £6000 for 50 years for the canal. After 99 years all the works become the property of the State.

16 - **The Elephant Butte Dam. The Greatest Irrigation Enterprise in America.** — *The Scientific American*, Vol. CXI, No. 5, pp. 73-74. New York, August 1, 1914.

The Elephant Butte project in Southern New Mexico, eighty miles north of Las Cruces, is rapidly nearing completion and will begin to store water the coming winter and spring.

This is the most notable project of the United States Reclamation Service. It will bring into cultivation 180 000 acres of land, most of which is situated in New Mexico and Texas.

The dam across the Rio Grande will be 1200 feet in length, the width of the roadway on the top will be 18 feet, the maximum height 300 feet;

maximum width at base 215 feet. It will have twelve water-gates. There will be 550 000 cubic yards of masonry in the structure.

It will create a reservoir 45 miles long, submerging 40 000 acres of land, and will contain 862 tousand million gallons of water. The maximum depth of water near the dam will be 193 feet and the average depth 66 feet. The total cost will be $ 7 200 000.

The annual flow of the Rio Grande at the dam is 800 000 acre-feet. The lands comprised in this project will require only 600 000 acre-feet at the most liberal estimate; there will thus be left in the reservoir, for emergencies, after it has once been filled, enough water to irrigate the whole acreage during more than two years of total drought.

17 – **The Distribution of the Overhead Electrical Discharge Employed in Recent Agricultural Experiments.** — JØGENSEN, I., and PRIESTLEY, J H. (Botanical Department, University of Leeds) in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 337-348 + 8 figs. Cambridge, September 1914.

For many years the effect of electricity upon the growth of plants has been a matter for speculation and experiment, but it is only in recent years that improvements in the methods of generating high tension electricity have permitted of well controlled experiments upon the problem. In these experiments the electricity is discharged from a system of thin insulated wires stretched over the crops. Since 1912 the writers have been studying this problem. At the Manor Farm, Garforth, Yorkshire, a high tension discharge system was installed, where the writers carried out a long series of measurements, on the basis of which they suggest in this paper certain modifications which should be made in subsequent field experiments on this subject.

Distribution and variation of discharge. — High-tension electricity of from 50 000 to 100 000 volts was generated by the Lodge-Newman system, and was supplied to an insulated network of wires raised some fifteen feet from the ground.

In order to study the distribution of the discharge from the network to the ground, the air in the neighbourhood was explored by an insulated candle flame electrode and connected with an Exner aluminium leaf electrometer with a range from about 50 to 800 volts. Close to the wires this electrometer had often to be replaced by a Braun electrometer with a range up to 4000 volts.

After an examination of the atmospheric electrical conditions, the discharge was switched on to the network and measurements were taken at a series of places outside the charged wires. At the same time the wind direction and its velocity were noted. A very large number of observations were made to determine the relation between the wind and the discharge. A difficulty in determining this relation is that the potential obtained at any point varies rapidly with slight alteration in wind velocity and direction. Therefore the curve of distribution of the discharge with the wind will be only approximate, but such curves were obtained by ascertaining the points where the potential, at a height of one metre from the ground, reaches the same value. All these equi-potential curves show the

great importance of winds in determining the distribution of the discharge. Later, as the crops advanced, reaching different heights at different points, the difference of potential was measured between two flame electrodes placed at different heights in the field. It was thus observed that the values are higher but more uniform under the wires, though it is difficult to draw conclusions as to the average potential gradient per centimetre. However on quiet days with no atmospheric disturbance the measurements show more agreement, which leads one to suppose that the discharge, when independent of the wind and of other disturbing factors, would occur in a uniform field except at points near the wires and near the plants.

Current density of the discharge. — After determining the potential gradient at various points in the experimental field, the strength of the discharge was measured by determinations of current density. For this purpose Gerdien's aspirator was employed to determine the specific conductivity of the air; then with the potential values determined, the current density can readily be calculated.

It proved very difficult to analyse the resulting figures for current strength, as the distribution of the discharge varies greatly with different atmospheric conditions.

For the purpose of a provisional classification of the various types of distribution of discharge, a study of the distribution of discharge *against* the wind proved of value and is made use of in distinguishing four types of discharge :

1. *Normal distribution in fine weather with the air free from serious contamination by smoke or dust.* In such conditions, with a wind velocity of from 3 to 4 miles an hour, the maximum distance the discharge is carried against the wind is about 25 yards; with stronger winds the distances diminish and the equi-potential curves under the wires are carried down with the wind until the potential gradient for the first 10 or 15 yards under the wires is less than the gradient just outside the wires to leeward. With this type of distribution the current strength at Garforth lay between 10^{-12} and 10^{-13} amp. (practical) per cm^2. With very strong winds it might fall as low as 10^{-14} amp/cm^2. At Lincluden an average value for the current under comparable conditions would be 4×10^{-12} amp/cm^2. The difference is probably due to the fact that the discharge wires used were of cotton-covered wire, while at Garforth they were of bare galvanized iron.

On a very windy day (the mean wind velocity was 27 miles per hour) the average potential gradient under the wires was 31 volts per cm. On such days the current *under* the wires is small.

2. *Fine weather with smoke contamination.* The distance the discharge is carried against the wind is not much greater than before, but a definite low potential is never reached and it is difficult to tell when the effect of the discharge ceases. The general feature of this type of distribution is the great variability and the high value of the current density, which may even reach the order of 10^{-12} amp./cm^2. under the wires. In other respects the distributions and variations of this type of discharge are governed by the same laws as those of the first type.

3. *Days on which condensation processes occur.* It is quite distinct from the distribution of the discharge under rain, when the phenomena approximate more nearly to the first type of distribution. This type gives the minimum values for the strength of the discharge and its distribution outside the wires is very limited. At Dumfries the variations lie between 10^{-15} and 10^{-14} amp/cm^2. At Garforth the figures are somewhat higher.

4. *Quiet weather with the presence of very rapidly moving ions, probably of a radio-active nature.* The discharge makes its way much further against the wind. The maximum value of discharge with this type of distribution, which also is the maximum value of all current measurements under the wires is 2.3×10^{-11} amp/cm^2.

The general form of a distribution curve of any of these four types apparently means that the distance the discharge is carried by the wind is proportional to the distance through which the wind has travelled under the wires.

Discussion. — It is now possible to institute quantitative comparisons between the electrical conditions over so-called electrical and control areas. Though the use of self-recording instruments will increase the accuracy of such comparisons, they will always remain approximate, on account of the many variables involved. At the same time it is contended that the means are now at hand to enable a sufficiently close investigation to be made of the effect of electric discharge in improving crop yield.

It is interesting to compare data for the current density of the discharge in the neighbourhood of the discharge wires with those given for normal atmospheric conditions. Under fine weather conditions the strength of the vertical current in the atmosphere is of the order 10^{-16} amp/cm^2; this figure does not vary very much in different parts of the world; the potential gradient is positive and of the order 1 volt per cm. More than 75 per cent of the rain is positively charged and the current densities are of the order 10^{-16} to 10^{-14} amp/cm^2. In thunderstorms the current densities considerably increase from 10^{-15} amp/cm^2 to 10^{-13} amp/cm^2. and even to strengths of 10^{-12} amp/cm^2. for shorter periods.

Measurements of the atmospheric current carried out in connection with this investigation agree with these figures. The average value for the normal current density at Garforth is approximately 5×10^{-16} amp/cm^2.

As one result of this investigation the fact has to be faced that the control and experimental areas in large scale field trials only differ from one another quantitatively and that the success of an investigation into the effect of overhead discharge upon crop production will depend in part upon the ratio between the average current densities on the electrified and control area. If the current from the discharge were limited to the " electrified area " of the field the ratio could be estimated as follows:

$$\frac{\text{Current density electrified area}}{\text{Current density control area}} = \frac{10^{-12}}{10^{-16}} = \frac{10\,000}{1}$$

But when the electrical and control areas lie close together, as they have done in all experiments so far, there will be many days when the direction and strength of the wind together with other factors reduce this ratio to the order of $\frac{10}{1}$.

The great experimental difficulty lies in the great variability of this ratio. In large scale field trials it is necessary to ensure that under all weather conditions the ratio between the two areas shall be as nearly as possible $\frac{10\,000}{1}$ and as seldom as possible fall to $\frac{10}{1}$.

Considerations of soil and exposure, which must be alike in both areas, render it difficult to separate the areas, and therefore the writers tried the effect of wire netting (half-inch mesh) raised between the electrified and control areas. It will be necessary to make the wire screen higher than the discharging net work and, if possible to keep it charged to a relatively low negative potential.

In the Dumfries experiments during 1913, a plot of one tenth of an acre situated some seventy yards away from the discharge network was entirely enclosed by a wire cage of half inch mesh netting, six feet high. Even this was not sufficient to keep it completely screened from the electrical effect. Such closed wire cages are in any case unsuitable controls, as several other factors associated with the plants' growth are altered under them, especially perhaps the moisture conditions.

In conclusion, the problem underlying the technique of these field trials has proved to be more complex than was anticipated.

MANURES AND MANURING

18 – **Compensation for the Unexhausted Manurial Values of Feeding Stuffs and Fertilizers.** — VOELCKER, J. A., and HALL, A. D., in *The Journal of the Royal Agricultural Society of England*, Vol. 74, pp. 104-119. London.

Owing to the rise in price of manurial ingredients and to the growing feeling that the spreading of compensation over a period of four years is alike inconvenient and not borne out by recent investigation or in actual agricultural practice, the writers issue in this paper a revised edition of their tables published in 1902.

The unit value of nitrogen is now taken at 15*s* instead of 12*s*, while potash and phosphoric acid remain at the same unit value as before, but the potash is now treated like the phosphoric acid in so far as only three-quarters of the amount in the feeding-stuff is reckoned as recovered in the manure. Recent experimental results (1) have shown that the nitrogen contained in purchased feeding-stuffs (and it is chiefly nitrogen for which compensation is paid) is, in the main, contained in digestible compounds and is therefore excreted from the animal as urea. This urea passes rapidly into ammonia, which is not only subject to loss in the manure, but also exerts its effect on the first and second crops only that are grown with the manure. The long continued effect of dung is due to the more slowly acting compounds of nitrogen contributed by the litter and the undigested residues of the

(1) See B. Dec. 1914, No. 1094. (*Ed*).

Compensation to be awarded for the use of fertilizers (fractions of originals cost of fertilizer).

	On arable land					On grass land						
	after 1st crop	after 2nd crop	after 3rd crop	after 4th crop	after 5th crop	after 1st year	after 2nd year	after 3rd year	after 4th year	after 5th year	after 6th year	after 7th year
Superphosphate	2/3	1/3	1/9	—	—	2/3	1/3	1/9	—	—	—	—
Bones (raw and steamed)	2/3	1/3	1/9	—	—	2/3	1/2	1/3	1/6	—	—	—
Dissolved bones	1/2	1/4	1/12	—	—	1/2	1/4	1/12	—	—	—	—
Basic slag	2/3	1/3	1/6	—	—	7/8	3/4	5/8	1/2	3/8	1/4	1/8
Bone manures	2/5	1/5	—	—	—	2/5	1/5	—	—	—	—	—
Compounds manures not containing bone	1/3	1/6	—	—	—	1/3	1/6	—	—	—	—	—
Peruvian guano	1/3	1/6	—	—	—	1/3	1/6	—	—	—	—	—
Fish guano	1/3	1/6	—	—	—	1/3	1/6	—	—	—	—	—
Meat meal	1/3	1/6	—	—	—	1/3	1/6	—	—	—	—	—
Shoddy and wool waste, hair, hoofs and horns, greaves etc	1/2	1/4	1/8	—	—	1/2	1/4	1/8	—	—	—	—
Manure cakes	1/5	1/10	—	—	—	1/5	1/10	—	—	—	—	—
Dried blood, sulphate of ammonia, nitrate of soda-nitrate of lime, cyanamide.	Nothing					Nothing			—	—	—	—
Kainit and potash salts	1/2	1/4	—	—	—	1/2	1/4	—	—	—	—	—
Lime	5/6	2/3	1/2	1/3	1/6	7/8	3/4	5/8	1/2	3/8	1/4	1/8

food (other than the concentrated feeding-stuffs). The period over which compensation shall be spread has therefore been reduced from four to two years, the compensation in the second year being reduced to half that of the first year.

A further change has been introduced to distinguish between the compensation to be paid for dung made in yards, when 50 per cent of the nitrogen is reckoned as before, and for cake fed directly on the land, in which case 70 per cent is allowed in the first year and 25 per cent. in the second; but it is still left to the valuer to make suitable deductions if the dung has been subjected to excessive losses in the making. No distinctions are made between food-stuffs fed to different classes of live stock, as it would be almost impossible to provide for all circumstances, and moreover it would be extremely difficult in practice to descriminate between the food given to the various classes of stock; but here again it is left to the discretion of the valuer to make suitable deductions if a large portion of the

ood were fed to young stock or to dairy cows kept indoors. Soya bean ake, earthnut cake, and Bombay cotton cake have been added to the list f feeding-stuffs considered.

A scale of compensation for the commoner fertilizers according to the umber of crops that have been taken since the application of the fertili-ers has also been drawn up and is reproduced in the adjoining table. The riters point out the general difficulty of compiling such a table owing to the ack of data on the subject and to the variation in crops and soils. They nly put forward the present scheme as a rough approximation which may e used as a basis, subject to modification according to local requirement, and hus be substituted with advantage for the haphazard systems of valuation t present adopted. A distinction is made between the application of ertilizers to arable land and to grass land, for where there is always a rop on the land, as in the case of grass, the constituents of the manure are nore fully retained than on arable land, and consequently compensation nust be allowed to extend over a longer period.

9 – **Is the Principle of the Lime-Magnesia Ratio a Hypothesis or a Proved Fact?** — LOEW, O., in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 5, pp. 733-752 + 1 fig. Berlin, 1914.

Considering the results of recent researches, Japanese in particular (1) nd other negative results of Haselhoff (*Landwirtschaftliche Jahrbücher*, 913, 609) the writer discusses the exceptions to his principle of the ime-magnesia ratio, and draws the following conclusions:

a) The principle of the lime-magnesia ratio is based on established acts, though some of the explanations offered should be considered as ypotheses. The experiments of several workers with water cultures, sand ultures and in open ground confirm this principle.

b) The deviations found by other investigators can be attributed to isturbances of the soil caused by the addition of lime, or to badly made ot cultures, or even to not having observed the law of minimum in the anures used.

c) The principle of the lime-magnesia ratio and the law of the inimum require the determination of the magnesium in the soil, which as not always be en done previously. A manurial dressing made in a ational manner on the results of the soil analysis is also of considerable mportance to live stock, since they require a forage rich in lime.

0 – **The Production of Available Phosphates by Furnace Treatment.** — PAYNE, J. H., in *The American Fertiliser*, Vol. XVI, No. 7, pp. 44-46. Philadelphia, October 3, 1914.

During the past three or four years various processes have been devised or producing available phosphates by heat, but up to the present they have ot been investigated scientifically. The writer has made a comparative xamination and groups them as follows: *a*) processes by which phosphoric nhydride is volatilised with formation of a solution in water; *b*) processes n which the tricalcium phosphate is rendered soluble in citrate by calcina-ion with various reagents.

(1) See *B.* Nov. 1914, No. 980. (*Ed.*)

Volatilisation processes. — When mineral phosphates are heated to a sufficiently high temperature for a considerable time in the presence of an acid such as silicic acid and a reducing agent like carbon, the whole of the phosphoric acid is volatilised and may be collected in an alkaline solution with formation of soluble phosphates. As internal combustion furnaces are not yet capable of producing the required temperatures, it is necessary to use an electric furnace, so that the suitability of the method will depend on the cost of the hydro-electric energy. The product realised should contain not less than 30 to 50 per cent of phosphoric anhydride soluble in water. An industrial plant for carrying out this method has been recently established near Charlotte, N. C., United States.

Calcination processes. — The first patent, already expired, was that of Dunne (*U. S. Patent* No. 245 625, 1886) ; it consisted in the production of water- and citrate-soluble phosphates by heating the mineral almost to fusion point, with alkali or alkaline salts in the proportion of 1 to 2 parts to every 2 of phosphate. The salts used were either sodium sulphate alone or a mixture of this with potassium sulphate ; coal was added to effect the decomposition of the sulphates.

Another patent, also expired, is that of Day (*U. S. Patent* No. 542 080, 1895) relating to a process for the production of citric-acid-soluble phosphates by treatment of the phosphatic mineral in a furnace, below the partial fusing point, with a quantity of calcium carbonate equivalent to or greater than the proportion in bone phosphate.

The Wiborgh Process (*U. S. Patent* No. 601 089, 1898, which expires on March 22, 1915) (1) produces a tetra-calcium sodium or potassium phosphate (10 CaO. 2 Na_2 O.3 P_2 O_5), soluble in Wagner's reagent, but insoluble in water. Wiborgh phosphate is produced by heating apatite to a red or yellow heat with substances containing sodium or potassium. The process differs from that of Dunne by the quantity of alkali used (from 6 to 40 per cent. instead of 50 to 100 per cent.).

The Baskerville process (1898) resembles the Wiborgh process, and being anticipated by it, could not be patented. The Newberry and Fishburne patents (date of application October 24, 1908, *U. S. Patent* No. 978 193) and Connor's patent (date of application October 14, 1908, *U. S. Patent* No. 931 846) are improvements of the Day process, since they give equally good results with less reagents at higher temperatures. In the Connor process 5 parts of phosphate are treated with one part of caustic soda and 2 parts of quicklime. In the Newberry process lime and alkaline carbonate are used in about half the proportion used in the Connor process.

After these patents there were a series of other patents dealing with calcination with alkaline or acid reagents at temperatures above a yellow-red heat. Omitting the use of acid reagents, it may be said that processes

(1) Invented by J. P. Wiborgh, of the Stockholm Technical College, in 1890, and applied in Sweden to powdered apatite, 20 000 tons being produced yearly. (H. v. Feilitzen, **Några ord om Fosfatindustrien**, pp. 30-31. Göteborg, 1912). (*Ed.*)

based on the use of lime or alkaline fluxes tend to reduce the quantity of the reagents and to increase the temperature, following the application of a rotary cement furnace. In every case the resulting product is essentially the same as Wiborgh phosphate.

The value of these products in practical agriculture depends : 1) on their cost of production, which should be less than that of superphosphate ; 2) on the percentage of available phosphate, which should be higher than in superphosphate ; 3) on their stability and their suitability for mixing with other manures. The writer is of opinion that all this will be achieved in time, to the great advantage of industry as well as agriculture. Except for improvements which cannot be foreseen, there is no reason to believe that the production of these manures can be monopolised, and their use is limited by their alkaline nature (they cannot be used with ammonium sulphate). Thus there will be an increasing tendency to distinguish the manures into two groups , acid and alkaline, each having its special field of action.

The calculated cost of production of a product by the Wiborgh process will eventually be $7.13 per ton of product containing 30 per cent of available phosphoric anhydride, *i. e.*, about 24 cents (1*s*) per unit of available phosphoric acid. This is assuming the process is carried out at the mine with natural 70 per cent phosphate costing $3.50 per ton. If the process is carried out in a manure factory (under the conditions of the United States) the cost will be about 29 cents per unit.

21 — **Further Information on the New Potash Deposits in Spain.** (1) — I. Dirección General de Agricultura, Minas y Montes. Principales disposiciones publicadas en la " Gaceta de Madrid " referentes a los servicios de Agricultura. 1º de Octubre, Real Decreto del Ministerio de Fomento relativo a la exclusion temporal o definitiva del derecho público de registro de terrenos francos, que designe este Ministerio, al objeto de investigar, descubrir y, en su caso, aprovechar criaderos de substancias minerales que puedan servir como abonos agrícolas o materia prima para la fabricación de los mismos. *Boletín de Agricultura Técnica y Económica*, Year 6, No. 70, pp. 858-862. Madrid, October 31, 1914. — II. Hurst, C. B. (V. S. Consul General, Barcelona). Potash Deposits in Spain. — *Daily Consular and Trade Reports*, Year 17, No. 261, pp. 615-617. Washington, November 6, 1914. — III. K.K. Generalkonsulat, Barcelona. Kalisalzlager in Katalonien. — *Das Handelsmuseum*, Vol. 29, No. 48, p. 542. Vienna, November 26, 1914.

I. — Pending the approval of the projected law presented on the 1st of July last and favourably received by the Spanish Congress and Senate, and in consideration of the discoveries made not only in Catalonia, but also in Santander, and of the new investigations in the Asturias, in Andalusia and in other regions, the Ministry of " Fomento " published on the 1st of October a Royal Decree reserving to the State the right of suspending, temporarily or permanently, the concessions of land that the Ministry intends to submit to investigation, and possibly also to exploit, for the production of minerals for use as artificial manures or for their manu-

(1) See *B.* Nov. 1914, No. 983. (*Ed.*).

facture (Art. 1). The Geological Institute of Spain is authorised to indic ate the lands which should be reserved for these investigations. Th work will be carried out by special technical bureaus under the directio of the Institute and under the control of the technical corps of the State The lands will be reserved for the state in three ways: 1) provisionall for preliminary studies ; 2) temporarily for complete researches ; 3) per manently for exploitation (Art. 6.). If the investigations directed by th Geological Institute lead to the discovery of the minerals in question o indicate their existence, the temporary reserve will be transformed int permanent reserve after the approbation of the Council of Mines (Art. 10) Further, the State has the power to alienate, sublet, or exploit for its ow use, the deposits reserved in accordance with the mining laws in forc in the districts where they are published. The mining engineers attache to the above-mentioned special bureaus will have the right to a specia premium on the value of the deposits discovered, at the rate of 1 per cen for a valuation below 5 million pesetas (£200 000) ; 0.75 per cent for a valu ation between 1 and 5 million pesetas, 0.5 per cent for a valuation abov 5 million pesetas. For the present the State reserves temporarily the land of the provinces of Barcelona and Lérida in which the Geological Institut has made search for potash salts ; and also the lands enclosed in the peri meter traced by the communes of Isona, Balaguer, Tarrega, Igualada Manresa, Vich and Berga (Art. 13). Further the right of extractio of potash salts will be suspended in cases in which they occur in concession granted for other minerals. Finally, the Geological Institute will proce immediately to make a detailed study of the land within the above-men tioned perimeter and submit to the Spanish Government the project an estimates relating to these researches ; it shall also issue forthwith an o ficial report on the works carried out and the results obtained.

II. — The Consul-general of the United States at Barcelona, in hi report on the situation of the deposits of potash salts already discovere believes that it will shortly be possible to place a certain quantity o potash salts on the market for local consumption ; but no conclusions ca be made regarding the possibility of a regular exportation.

III. — The Austro-Hungarian Consul-general at Barcelona has als made a report on the potash deposits of Catalonia, in which he gives th details on the present state of the concessions. Whilst a Spanish-Swis syndicate (including the " Sociedad Anonima Cros ", which manufacture chemical manures at Barcelona), the " Sociedad Electro-quimíca de Flix " and a German company connected with the German Potash Syndicat are at present engaged in technical and geological researches on the lands the Franco-Spanish group Macar (Bordeaux) and Viader (Barcelona which has already discovered deposits, has formed a company for exploit tion and has already commenced operations. In any case the demand for concessions are as follows : Macar and Viader for 19 848 acres ; S. Ve dagner for the Spanish-Swiss group for 91 474 acres ; the German compan for 99 000 acres adjacent to the Macar and Viader concession ; the Spanis

subjects Ripoll Furtuño for 50 144 acres ; and Marinello for 18 751 acres ; making a total of about 280 000 acres.

In the opinion of a French technical expert, the new Spanish deposits compare in richness and quality with the best German deposits, and have the additional advantage of being more easily accessible. Up to the present Spain has imported an average of more than 30 million pesetas (£1 200 000) worth of chemical manures annually.

22 – **The Conversion of Grape Pomace into Manure.** — Roos, L., in *Le Progrès Agricole et Viticole*, Year 31, No. 44, pp. 441-442. Montpellier, November 1, 1914.

Ordinary grape pomace contains a considerable proportion of fertilising substances (1), but these are not available to plants on account of the acidity of the pomace. The treatment proposed consists in destroying this acidity and at the same time enriching the mass in fertilising matter.

A roughly weighed quantity of the pomace is spread on selected ground in a lightly pressed layer 8 to 10 in. deep ; if re-extracted pomace is used , it is left to drip for 36 or 48 hours before spreading. The surface is then sprinkled with 4 per cent of basic slag (containing 15 per cent phosphoric acid and 50 per cent lime) ; or 2 per cent of ordinary slaked lime with 2 per cent of precipitated phosphate (containing 30 per cent phosphoric anhydride) ; or an equivalent quantity of ground natural phosphate ; finally 2 per cent of sulphate of potash, which may be reduced to 1.5 or even 1 per cent if the pomace is not too exhausted, is spread over the mixture. In another vessel an artificial liquid manure is made as follows : water 10 gallons, quicklime 1 lb., sulphate of ammonia 2 ½ lbs. ; the quicklime is first slaked with a little water and made into a milk with the rest of the water, then the sulphate of ammonia is added and the liquid stirred vigorously for 15 minutes until the salt is completely dissolved. If the pomace is pressed and has not been re-extracted it is better to double the quantity of water. The first layer of pomace is watered copiously with about 7 gallons of the artificial liquid manure per sq. yard, and with double the quantity if the pomace is pressed and the liquid is at half strength. The operation is repeated as often as desired, taking care to cover the last layer with 2 to 4 inches of earth. At the end of a short time a very active fermentation sets in, which is allowed to continue for three weeks. The heap is then opened up and remade 6 ft. away. The fermentation begins again, but less actively, and the pomace become very friable. When ready for use it is again turned over to facilitate thorough mixing.

(1) According to Muntz and Girard (Les Engrais, I, 538, 5th edition), the percentage composition of ordinary pomace with $^{2}/_{3}$ its weight of water is as follows :

	I.	II.	III.	IV.
Nitrogen	1.11	1.22	1.30	0.81
Phosphoric anhydride . . .	0.25	0.33	0.25	0.28
Potash	0.90	1.63	0.86	0.20

The last sample was taken from a re-extracted pomace. (*Ed.*).

Applied at the rate of 6 ½ lbs. per vine (planted 45 ft. apart) it acts as a complete manure assimilable in all soils, since it contains sufficient alkalinity for good nitrification.

BIBLIOGRAPHICAL NOTE.

23 – VAN DER DAAT, F. J. (Director of the Department of Agriculture, Costa-Rica). — *Los abonos en Centro América.* (Manures in Central Ameriea). San José de Costa Rica Imprenta y Litografia del Comercio, 1914 (1 vol., large 8vo, pp. 53 + 3 diagr.).

Chapters I to V deal with the principles of rational manuring and in a detailed manner with the conditions of the tropical soils of Central America. Chapter VI gives the results obtained in these regions with chemical manures, especially in plantations of coffee, sugarcane, tobacco, bananas and cacao, on cereal crops (hill rice and maize), on hoed crops (" papas " and " yuca "), in fruit plantations (citrus), and on pastures.

The writer concludes by stating that all the lands of Central America require manuring to a considerable extent. Existing plantations require manures to restore their normal fertility and virgin productivity. They are also required in new plantations to maintain their present fertility undiminished, since in this matter also prevention is better than cure (1).

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

24 – **Methods of Estimation of Carbohydrates. III: The Cupric Reducing Power of the Pentoses Xylose and Arabinose.** (2). — DAISH, A. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp, 255-262. Cambridge, September 1914.

In the scheme of analysis of plant extracts described in former papers, before it is possible to calculate the proportion of dextrose and laevulose an allowance must be made for the pentoses present; it therefore became necessary to ascertain the exact value of the cupric reducing power of these sugars under the standard conditions adopted. Values of cupric reducing power of xylose and arabinose have already been given by other workers, but as they were obtained under conditions different from the standard ones mentioned above, it became necessary to make a fresh series of determinations. Xylose and arabinose being the only pentoses which are at all readily obtainable, attention was limited to these, and their reducing powers proved to be almost identical and to differ only very slightly from that of dextrose. For practical purposes, when working with unknown pentoses in plant extracts, it is probable that no very large error will be incurred by taking the average value for arabinose and xylose in calculating the amount of total pentoses present.

25 – **The Urease Content of Certain Indian Seeds.** — ANNETT, H. E., in *The Biochemical Journal*, Vol. VIII, No. 5, pp. 449-452. Cambridge, October 1914.

Since soy beans have been used as a source of urease for estimating urea, it was thought desirable to test the urease activity of different varieties of soy beans as well as other seeds. The tests were made by extracting the powdered seed in distilled water in the presence of toluene and

(1) See: *B.* Sept. 1913, No. 1278; *B.* Jan. 1914, No. 11. (*Ed.*).
(2) See also *B.* Jan. 1914, No. 22; Dec. 1914, No. 1100. (*Ed.*).

estimating the ammonium carbonate produced from a one per cent solution of urea when treated with extract. The ammonia is estimated by titration with $\frac{N}{10}$ hydrochloric acid.

It was found that urease was present in the following seeds: soy bean yellow, soy bean spotted, soy bean chocolate, soy bean common, soy bean black, sword bean (*Canavalia ensiformis*) both American and Indian, *Urana lobata*, *Dolichos biflora*, castor bean (*Ricinus communis*). The sword bean contained the greatest quantity of urease, about 3 to 4 times the amount in soy beans.

The absence of urease was indicated in the following seeds: French beans (*Phaseolus vulgaris*), velvet beans (*Mucuna pruriens*), Sona mung (*Phaseolus radiatus*), *Sida* sp. (Burma), *Sida cordifolia*, white til (*Sesamum indicum*), black til (*S. indicum*), *Phaseolus mungo*, cowpea (*Vigna catjang*), white mustard (*Brassica campestris* var. *sarson*), red mustard (*Brassica campestris* var. *dichotoma*), Niger (*Guizotia abysssinica*), Taramira (*Eruca sativa*), sweet pea (*Lathyrus sativus*), *Sida spinosa*, rice (*Oryza sativa*), Cowa (*Setaria italica*), peas (*Pisum arvense*), gram (*Cicer arietinum*).

26 – **The Influence of Zinc Vessels in Culture Experiments.** (1) — GHEDROIZ, K., in *Selskoie Khostaistvo i Lessovodstvo* (Agriculture and Forestry), Year 74, No. 245, pp. 625-627. Petrograd, August 1, 1914.

Experiments carried out during three years show that sulphate and chloride of zinc have almost similar effects on the growth of mustard. The action of zinc on barley differs from that on mustard. Experiments carried out with vessels 8 × 8 in., each containing 5 kg. (11 lbs.) of dry soil gave the following results:

Barley.	Average yield of each vessel — gms.
Without zinc	70.9
With 0.0005 zinc	64–65.2
» 0.005	40.9–42.7
» 0.01	40.9–42.7
» 0.02	26.8–10.2
» 0.04	1.5–1.7
» 0.05	0–0

Mustard.	Average yield of each vessel — gms.
Without zinc	25.5
With 0.0005	30.7—29.6
» 0.0025	18.3—18.8
» 0.005	11.4—13.1
» 0.01	2.1—1.6
» 0.02	0—0

(1) See also *B.* June 1914, No. 508. (*Ed.*)

This table shows that whilst with 0.02 zinc the growth of mustard ceases, barley gives a relatively good yield. Also, zinc in very small quantities has a depressing effect on the yield of barley, whilst on mustard it has a stimulating effect.

A long series of experiments with zinc vessels has shown that red clover (*Trifolium pratense*) grown in acid soils loses its germinating power or grows very badly in the third year. Three years' experiments with zinc and ebonite vessels containing soils with and without acid reaction, manured and unmanured, with and without carbonate of lime, have shown that the injurious action of zinc vessels on the growth of clover is apparent in the second year and much greater in the third year, and that it is increased by the acidity of the soil.

27 – **Studies on the Transpiring Power of Plants as indicated by the Method of Standardised Hygrometric Paper.** — BAKKE, A. L., in *The Journal of Ecology*, Vol. II, No. 3, pp. 145-173. Cambridge, September 1914.

These experiments illustrate the value of the well-known cobalt paper method of STAHL as means of comparing the trasnpiring power of a leaf surface with the power of a free water surface to give off water by evaporation.

To avoid some of the difficulties arising from the use of the free water surface, HARVEY made use of saturated blotting paper as standard evaporating surface.

The ratio of the time required for colour change of the hygrometric paper over the standard water surface, to the corresponding time required for the same change when the paper is applied to the plant surface, has been termed by LIVINGSTON the *index of transpiring power*. The means of determining this ratio enables the subject of xerophytism in leaves to be studied quantitatively.

With a view to dispensing with the standard surface of evaporation, the relation between the air temperature and rate of transpiration was determined. Although this relation was found to be similar to that between temperature and the vapour pressure of water, it requires more accurate determination before actual standardisation of the test paper is possible.

By means of this method the following studies on transpiration were conducted : 1) daily progress of foliar transpiring power ; 2) relation of position upon the plant and age of leaves to their transpiring power ; 3) relation of diurnal to nocturnal foliar transpiring power ; 4) transpiring power as an index of xerophytism or of mesophytism ; 5) transpiring power of floral parts ; 6) relation of foliar transpiring power to the phenomenon of wilting ; 7) transpiring power as an index of drought resistance.

The data obtained in these studies show that : 1) the index of transpiring power remains approximately constant and at low value during the night, but suddenly increases at sunrise, reaching a maximum before the occurrence of the daily maximum of temperature or of evaporation, and then falls to the night value ; 2) the transpiring power of the leaves of a given plant gradually increases as the position of the leaves is further from the ground, up to a certain maximum, then it decreases towards the leaves of the

crown ; 3) the more xerophilous forms generally possess lower diurnal than nocturnal transpiring power and the more mesophilous plants are characterised by greater diurnal than nocturnal power to give off water ; 4) plants growing under more and under less arid conditions of the soil and air show differences in transpiring power, suggesting that the same species may possess quite different indices when grown under moist conditions than when grown under dry conditions; 5) resistance to transpiration increases at wilting, and incipient drying before wilting occurs also produces increased resistance.

It is suggested that the ecological classification of plants should be determined quantitatively by reference to the average index of transpiring power of the particular plant, and that this method could be applied to the agricultural problem of determining the relative drought resistance of different crops and of different strains of crops. It appears also that the foliar transpiring power is characteristic for any given plant, and it may therefore prove useful in predicting the need of irrigation long before the occurrence of any wilting.

28 - **On the Calciphobe Nature of Lupins and their Unsuitability to Heavy Soils.** — CAUDA, ADOLFO, in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part 8, pp. 627-632.

Agriculturists have agreed in regarding the lupin as a plant avoiding calcareous soil and which does not grow well on clay. If this idea is generally correct, it has nevertheless no absolute truth, as has been shown by the results of pot experiments carried out by the writer at the Agricultural Station of Halle a/S. To every pot containing 2 kg. of soil (humous clay with 1 per cent. of carbonates) from the Lauchstädt experimental farm, were added respectively the following compounds: calcium carbonate (2 and 10 per cent), calcium oxide (2 per cent), monocalcic phosphate (5 per cent), precipitated phosphate (5 per cent.). After three days' repeated mixing, he sowed in the soil (January 30, 1911) *Lupinus luteus*, the variety considered to be the most susceptible to the presence of lime. When required, the pots were uniformly watered with distilled water.

Already on February 16, the injurious effects of monocalcic phosphate and precipitated phosphates were clearly seen ; for while the seedlings in the control pots and in those which had received 2 and 10 per cent of calcium carbonate, were 8 to 10 cm. high, and those which had received 2 per cent calcium oxide had reached a height of 6 to 8 cm., the seedlings in the receptacles containing 5 per cent. of mono-calcic phosphate were 2 cm. high at the most, and those with 5 per cent of precipitated phosphate from 2 to 4 cm.

The differences continued, though they were less marked, and on February 22, when the plants were gathered, the following data were obtained. These agree with the preceding observations.

	Shoots		Roots	
	fresh	dry	fresh	dry
	gms.	gms.	gms.	gms.
Control	17.72	1.41	2.07	0.21
With 2 per cent calcium carbonate . . .	18.47	1.39	1.96	0.18
With 10 per cent calcium carbonate . .	17.85	1.50	1.83	0.22
With 2 per cent calcium oxide	16.81	1.47	1.48	0.17
With 5 per cent monocalcic phosphate .	11.44	1.42	0.95	0.13
With 5 per cent precipitated phoshate . .	14.60	1.49	2.29	0.16

It may thus be deduced that lupins grown under the above-mentioned conditions do not suffer from the presence of 10 per cent of calcium carbonate, and that the injurious effect of calcium oxide and monocalcic phosphate was due to the respective basic and acid action of these compounds, rather than to the lime.

The writer made a second series of experiments using various kinds of soil :

a) Soil from Lauchstädt.

b) Light soil from a rice-field, free from lime (Lomellina).

c) Very calcareous soil from a vineyard (Langhe).

He measured the height attained by the seedlings about a month after sowing in the different pots and found that calcium oxide (2 per cent) alone was injurious, and that the harmful effects of calcium oxide and monocalcic phosphate were neutralized if these compounds were used in the proportion of 2 per cent of each. Calcium oxide (2 per cent) also showed a retarding action, even in the presence of calcium carbonate (2 per cent). The best development was obtained with monocalcic phosphate (2 per cent) combined with calcium carbonate (2 per cent). The most harmful effect was produced by calcium oxide (1.5 per cent) mixed with potassium chloride (1 per cent). Monocalcic phosphate (2 per cent) applied at the same time as potassium chloride (1 per cent) was less harmful.

The lime of the vineyard soil had no perceptible effect upon the growth of the lupins, which attained the same development when planted in it as in Lauchstädt soil (compact) or rice-field soil (light).

These experiments, which only deal with the first developmental period of the lupin, agree with the experiments lately made on the influence of lime by Dr. HEINZE at the Lauchstädt experimental farm. The dissimilar results obtained by other investigators who used sandy and heavy soils may perhaps be attributable to the fact that the injurious effect of calcium compounds is most marked in such soils.

The lupin also grows well in heavy soil, and, in the presence of suitable nutriment and of the necessary micro-organisms, gives the largest crops,

such as those obtained in the open at Lauchstädt with the blue lupin used for green manure.

It should therefore be observed that absence of lime is a less important factor in growing lupins than good preparation of the soil and its adaptation to the requirements of the plant by means of repeated cultivation and inoculation, when necessary, with bacteria.

Results.— The yellow lupin grown (in pots) in the Lauchstädt soil, a clay rich in humus, stood during its first vegetative stages 10 per cent of calcium carbonate, but was injured by the presence of calcium oxide (2 per cent), monocalcic phosphate (5 per cent) and precipitated phosphate (5 per cent). The injurious action of monocalcic phosphate is totally removed by the addition of calcium carbonate, and partially neutralised by potassium chloride, so that it should be attributed not to the calcium but to the concentration of the hydrogen ions in the monobasic phosphate.

Good crops of lupins can be obtained on heavy soil.

29 – **Selection and Variety Wheat Trials at the Rutherglen Experiment Farm, Victoria, Australia.** — RICHARDSON, A. E. V., in *The Journal of the Department of Agriculture of Victoria*, Vol. XII, Part 5, pp. 297-299. Melbourne, May 1914. PLANT BREEDING

A set of variety and selection tests were conducted at the Rutherglen Experiment Farm with the object of testing the suitability of different varieties of wheat to the conditions of the North East of the State of Victoria and to gauge their yielding capacity when sown under similar conditions. In the scheme of improvement by selection, four sets of plots are used: stud plots, selection plots, seed plots, and bulk plots. In the stud rows pure selected types of wheats derived originally from pure lines are grown each year. The selection plots are one-twentieth of an acre each in area, and originated in the first place from selected pure strains in the stud rows. From each of these selection plots sufficient graded seed from the best heads of the best plants is raised each season to sow a similar plot the following year. The rest of the selection plot is harvested to provide for the seed plot. In its turn, the seed plot provides seed for the bulk plots, the seed of which is distributed amongst farmers. Besides providing for gradual improvement of the bulk seed by repeated selection of the seed in the selection plots, the system of plots is used as a competitive ground for the ultimate choice of the most prolific types of wheat.

In 1913, in the selection plots, twenty-eight varieties were sown, and three check plots of Federation. The results are shown in Table I.

The variety trials consisted of twenty-two plots each of 0.45 acre in area. As far as possible each set of plots was treated precisely alike. The yields from the variety plots are shown in Table II.

A comparison between the two tables shows a marked difference in yield in favour of the selected plots, ranging from a minimum increase of 3 bushels 48 lbs. in the case of White Tuscan to a maximum increase of 12 bushels 54 lbs. in the case of Gluyas; the average increase amounts to 8 bushels 10 lbs. per acre. The tables show that the responsiveness of different varieties to selection varies considerably. The possibility of

TABLE I. — *Yields of selection plots, Rutherglen,* 1913.

Vasiety	Yield per acre		Variety	Yield per acre	
	bus.	lb.		bus.	lb.
Federation	34	0	Firbank	23	47
Yandilla King	35	22	Thew	28	40
Genoa	26	48	Bunyip	29	21
American 8.	34	26	College Eclipse	37	31
Huguenot	24	33	Gluyas	29	26
Dart's Imperial	29	40	King's Early	36	7
Zealand Blue	30	0	Commonwealth	30	18
Marshall's No. 3	31	21	Currawa	30	35
Triumph	32	18	Cleveland	29	43
White Tuscan	28	21	Gamma	27	32
Federation (3rd Seln.)	36	32	Jonathan	24	25
Bobs	23	37	White Fife	22	46
Warren	29	8	Minnesota 163.	20	28
Bayah	30	53	Purple Straw	26	8
Viking.	31	52	Federation	33	40

TABLE II. — *Results of variety tests, Rutherglen,* 1913.

Variety	Yield per acre		Variety	Yield per acre	
	bus.	lb.		bus.	lb.
Federation	29	11	Bobs	17	40
Yandilla King	28	47	Warren	18	31
Genoa	19	41	Bayah	23	4
American 8	23	7	Viking	21	38
Huguenot	12	0	Firbank	17	0
Dart's Imperial.	25	14	Thew	21	44
Zealand Blue.	21	24	Bunyip	23	36
Marshall's No. 3	26	40	College Eclipse	27	2
Triumph	23	4	Gluyas	16	42
White Tuscan	24	33	King's Early	22	7
Federation	28	4	Federation	26	31

improvement by selection varies thus with the variety. This is confirmed by the results of a special set of plots designed to test the normal range of variation from year to year of four standard varieties of wheat.

30 – **The Inheritance of Endosperm Texture in Sweet × Waxy Hybrids of Maize.** — COLLINS, G. N., and KEMPTON, J. H., in *The American Naturalist*, Vol. XLVIII, No. 574. pp. 584-595. Lancaster, Pa., October 1914.

It has previously been shown that the result of crossing varieties of maize having sweet and waxy endosperm was the production of seeds with a horny endosperm resembling that of ordinary field varieties. This work has now been carried to the F_3 generation.

In the F_2 generation three kinds of endosperm reappeared in the proportion of 9 horny, 4 sweet and 3 waxy. The results of the F3 generation were in accordance with Mendelian expectation. Seventeen self-pollinated ears were secured from plants grown from sweet seeds. All the seeds of these ears were sweet, with the exception of one waxy seed, which was also coloured and since it occurred on an ear from a white seed it may reasonably be ascribed to foreign pollen.

Of the three types of all waxy hybrids in F_2 one of them should breed true to type and the other two should give rise to both waxy and sweet in ratio of 3 : 1. The actual trial gave 18 ears showing both waxy and sweet seeds and of the 3 154 seeds on these, 803 were sweet, thus giving a deviation from the expected result of less than 2 per cent.

The sweet seeds occurring on ears grown from waxy seeds constitute a new type of sweet seed represented gametically as $S \times S \times$, distinct from the original parental form (SS). These are being planted separately for comparison with the ordinary sweet seeds occurring on ears having horny and sweet seeds together.

Considering the progeny of the horny seed, 30 ears were secured from such seeds, and are classed as follows : 1 all horny, 5 with horny and sweet seeds, 3 with horny and waxy seeds, 19 with horny, sweet and waxy seeds and 2 *all sweet*. The expectation is 1 all horny, 2 with horny and sweet, 2 horny and waxy and 4 with horny, sweet and waxy. The appearance of 2 all sweet ears may be explained on the assumption that seeds classed as horny in 1912 were in reality sweet. Further, they were only distinguished by their wrinkledness and not as a result of microscopic examination of the starch. The remaining 28 ears are considered to be distributed among the 3 classes in reasonably close agreement to the expected. In analysing the ratios in the different classes, the proportion of sweet seeds is too low and the percentage of waxy and horny seeds is consequently too high. It is suggested that the deficiency of the sweet class may result from a failure of some sweet seeds to develop a wrinkled exterior rather than from any irregularities in segregation.

31 – **A New Hybrid Poplar.** — HENRY, A., in *The Gardener's Chronicle*, Vol. LVI, No. 1451, pp. 257-258 + 2 figs. London, October 17, 1914.

It has previously been shown that the great vigour of the Huntingdon Elm, Lucombe Oak and Black Italian Poplar is due to the fact that

these trees are F_1 hybrids. Other valuable first generation hybrids are the London Plane, Common Lime and Cricket-bat Willow. These species have been produced by natural cross-fertilisation between trees of different species, and these facts suggested to the writer the great possibilities in making artificial crosses between other species of timber trees.

Several promising hybrids have been obtained, of which those between poplar species have made most advance. A female Carolina poplar (*P. angulata*) was crossed with the pollen of *P. trichocarpa* at Kew, in 1912. Four seedlings were obtained the same year and reached about 2 inches in height by the end of October. They grew remarkably during 1913, attaining a height of 3 ft. 6 in, 3 ft. 1 in, and 2 ft. 11 in. Two of them were checked by transplanting during the winter and the two remaining grew to a height of 7 ft. 6 in. and 10 ft. 1 in. respectively during this year.

One of these hybrids, known as *Populus generosa*, is also remarkable for its handsome appearance, having beautiful large leaves with conspicuous red veins. It promises to rival, if not excel, the remarkable hybrids at Metz, *P. eugenia* and *P. robusta*.

32 – **Hypothesis to account for the Abnormal Citrus Hybrids in Swingle's Experiments.** — HAGEDOORN, A. C., and HAGEDOORN, A. L., in *The American Naturalist* Vol. XLVIII, No. 571, pp. 446-448. Lancaster, Pa., July 1914.

In cross-breeding experiments with different forms of *Citrus*, Swingle found that, though the parental types appeared to breed true, the F_1 generation in all cases consisted of many different types, each of which only reproduced its own form when self-fertilized.

The writers offer the following explanation of these facts. The occurrence of multiform types in the F_1 generation implies a heterozygous condition of the parents. Considering the tendency for the production of adventitious embryos in *Citrus* and the consequent self-sterility, it is very probable that the seeds normally produced by the trees used in these experiments originated asexually as buds and therefore reproduced their parental forms, thus masking their heterozygous condition. Similarly the F_1 hybrids would be self-sterile and their heterozygous condition would not appear in their asexually produced offspring.

CEREAL AND PULSE CROPS

33 - **On the Anthesis of Some Varieties of Spring Wheat.** — GITKOVA, L., in *Giurnal Opytnoi Agronomyi* (Journal of Experimental Agriculture), Year 15, Vol. 3, pp. 155-176. Petrograd, 1914.

At the Saratoff Experiment Station the Poltavka, Russak and Belotourka types of spring wheat were experimented upon in 1912. These wheats are the most widely spread in the South-East of Russia and belong to the botanical forms *Lutescens*, *Erythrospermum* and *Hordeiforme*. In 1913 observations were made on the same types of wheat and on a new species of Turkestan wheat belonging to the botanical form *Graecum*, which for the characters of the ear (especially of the cuticle) was divided into two breeds: "coarse *Graecum*" and "fine *Graecum*". Of each form, 10 ears were subjected to observation. The observers relieved each other every two hours, from 3 a.m. to 9 p.m. every day.

The results of the observations may be summarized as follows :

I. In 1912 flowering in the two forms *Lutescens* and *Hordeiforme* was most intense between 5 and 7 a.m., with a second maximum between 5 and 6 p.m.

The flowering of the *Erythrospermum* form continues throughout the whole day more or less equally. In 1913 all three forms flowered equally throughout the whole day. *Hordeiforme* deserves special attention. It is believed that it flowers also throughout the night, because at 2.45 a.m., before it was quite light, flowering spikelets could be seen.

The duration of flowering was not the same in these two years. In 1912 it was very short, the greater part of the ears having flowered after 3 days. In 1913 flowering lasted 6 days. These differences of duration, according to the writer, must be attributed to the meteorological conditions of the two years, which exerted their influence not only at the moment of flowering, but during the whole period of vegetation. In fact the summer of 1912 was very warm and dry, while in 1913 it was mild and moist.

The *Graecum* forms flowered very quickly; one half had flowered in three days.

II. As in 1912, so in 1913 it was noticed that the three anthers do not all issue from the flower as they should do normally, but only two and sometimes only one. It was also noticed that sometimes a compression of the anther takes place, and that then it does not issue completely ; the inner pale closes before the anther has freed itself.

But the forms do not all behave alike ; thus for instance while in 1912 the greater part of the ears of the *Erythrospermum* form (61.5 per cent) flowered with the issue of only one anther, *Lutescens* flowered to a great extent (45.9 per cent) with the issue of all three anthers, and only in 14 per cent of the cases with only one anther. From the 1913 observations it appears that fine *Greacum* gave the greatest proportion of flowers with only one anther out (39.3 per cent) ; the second place was occupied by *Erythrospermum* (14 per cent); the other forms flowered normally with the issue of three anthers. Comparing the results recorded in these two years with the two forms *Lutescens* and *Erythrospermum* it will be seen that meteorological conditions have an unequal effect on them. Thus in *Lutescens* the year 1913, which was favourable, did not alter noticeably the ratio between the flowering with one, two or three anthers as compared with that of 1912. In *Erythrospermum* it was different, and the normal flowers with three anthers, which in 1912 were 3.7 per cent, became 32.2 per cent in 1913; the flowers with only one anther, which were 61.5 per cent in 1912, were reduced in 1913 to 14 per cent. It must be noted that the two forms *Lutescens* and *Erythrospermum* flowered on the same days in 1912 and in 1913, which signifies that they were in the same conditions of climate; consequently the difference must be attributed only to their breed.

The *Greaecum* forms differ very much from each other. The fine *Graecum* flowered most with the issue of only one anther; the coarse *Graecum* gave a greater number of normal flowers, namely with three anthers.

34 - **The Cultivation of Rice in Spain.** — BUTLER. E. J., in *The Agricultural Journ of India*, Vol. IX, Part IV, pp. 326-335. Calcutta, October 1914.

Spain occupies the second place among the rice-growing countries o Europe, 96 000 acres being devoted to this crop, against 360 000 in Italy One of the chief difficulties in the way of an extension of the area is th existing prejudice based on the supposed danger of inducing malaria.

The method of cultivation of this crop in Spain is characterised b its similarity to the methods in use in Asia, *viz.* the continuous cultivatio on the same land and the transplanting of the seedlings, which is unknow elsewhere in Europe. The Asiatic method of transplantation combine with the scientific cultivation of the soil by modern implements and th use of artificial manures has brought rice cultivation in Valencia to a highe pitch of perfection than anywhere else in the world. This is supporte by the figures (1) for the yield per acre in the most important countrie which show that the average yield in Spain (5700 lbs. per acre) is nearl twice that of Italy, more than twice that of Japan and about six time that of India.

35 - **Most Suitable Varieties of Maize for Growing in Montana.** — WILSON, M. L in *Montana Agricultural College Experiment Station, Circular* 41, 74 pp. Bozeman Mon tana, June 1914.

According to the results of experiments conducted by many farmer and of investigations made at the Montana Experiment Station, the write recommends growing the following varieties :

1st group : Early Flints. — Dakota White Flint, Gehu Flint (yellow) Burleigh County Mixed, Early Square Mixed. This group originated i North Dakota and is derived from the old native maize : Mandan India Corn. It gave the highest yield of all the varieties tried in dry cultivation It is the earliest and is very hardy; it stands hail well.

2nd group : Early Dents. — Brown County Dent (yellow), Bustler' White Dent, Scour Chief (bronze coloured). They ripen 10 to 15 day later than those of the first group.

3rd group : Semi-Dents. — Minnesota King (yellow), Minnesota No. 2 (white), North-Western Dent (red). These varieties are intermediate be tween the flints and the dents.

4th group : Late Flints. — Triumph, Mercer, Smutnose, Longfello (yellow), King Philip (red), Disco Amber (light red). They ripen onl in the lowest valleys of the State. For the exceptional slenderness o the stalks and abundance of leaves this group is the most suitable fo ensilage and for fodder.

5th group : Late Dents. — The stalks grow to a height of 5 to 7 f The plants are, however, somewhat coarse and are therefore not s suitable for fodder and ensilage.

In 1913 at the Wibaux Demonstration Farm the following yields o grain per acre were obtained from the various groups :

(1) See *International Institute of Agriculture, Bulletin of Agricultural and Commerci Statistics*, Vol, V, No. 3, p. 92. Rome, March, 1914.

	Bushels per acre
Early Flints	42
Semi-Dents	37
Early Dents	32
Late Flints	30
Late Dents	28

6 – **Forage Crops for Semi-Arid Regions.** — SCUDDER, H. D. (Agronomist, Oregon Expt Station). — *Oregon Agricultural College Experiment Station, Corvallis, Bulletin* No. 119 188 pp. + 84 figs. Corvallis, 1914.

Alfalfa. — All the farmers who had grown alfalfa on the dry lands f Oregon did it to cut for hay, and sowed it broadcast, but they did not in ll cases obtain favourable results. The writer advised sowing it in rows, nd considering the promising results obtained, and the fact that where ioisture is scarce plants while developing less in stalk and leaf produce n abundant crop of seed, the planting of alfalfa in rows for seed production as undertaken on the Experiment Stations and demonstration farms f the Columbia Basin and Central Oregon, as well as with cooperating armers. The object aimed at was to secure a strain of alfalfa that would ieet the following requirements; 1) produce a seed crop quickly and iature it before the autumn frosts; 2) be sufficiently hardy at the high-st altitudes (from 2000 to 4000 feet (to withstand the cold with practi-ally no snow cover for protection; 3) be a vigorous rooter and resistant to rought; 4) produce an abundant crop of seed; 5) produce a reasonably ood growth and quality of forage or hay.

Alfalfa for the production of seed. — Seed of the most promising vari-ties was obtained from different parts of the world and trials with them ere started some years ago at the Corvallis Station. Both there and iroughout the Columbia Basin and Central Oregon the best results from very point of view were obtained with the Baltic strain of common alfalfa.

This strain properly cultivated will produce from 100 to 300 lbs. of eed per acre. Moreover this seed grown in the humid regions at lower levations, such as in Western Oregon, will produce a far superior crop ian seed grown in warmer climates and lower altitudes, such as in Cali-ornia, Kansas and Utah, and consequently commands a higher price. Where this strain of seed cannot be secured the Grimm is believed to be ie next best.

The methods of cultivation recommended by the writer on the dry nds are as follows:

After the grain harvest, the stubble is double disked, then ploughed eeply in the autumn. In spring, as early as possible, the ground is disked ioroughly and then kept well cultivated, mulched and clean of weeds until eeding time, which is about the middle of April in the Columbia Basin id about May 15 in Central Oregon.

If the previous crop was a hoed one or field peas in rows, the ground eed not be ploughed, but may be throroughly disked in the autumn and the spring. Where the ground is unusually foul with weeds or where the

subsoil moisture supply is greatly reduced, the dry lands should be summe fallowed prior to seeding alfalfa.

On the dry-farming lands alfalfa should be sown in single dri rows 35 inches apart and just as thinly in the row as possible. Th ordinary grain drill may be used with the extra parts called " alfalfa redu cing plates " or wire riddles so as to reduce the amount of seed to two o three pounds per acre, and, with the best seed and the seed-bed in goo condition, even a pound and a half will give an ample stand. One plan about every 8 inches in the row is about what is desired in the 10-inc rainfall belt. The seed should be put in not deeper than 1 ½ inches an then rolled or pressed. In all cases the rows should be seeded at right angle to the direction of the prevailing winds. After seeding, the ground may b harrowed as often as is necessary to maintain a good mulch and kee down the weeds. When the plants are 2 to 3 inches high they should b cross-harrowed severely or even disked crosswise until the stand is reduce to one plant every 12 to 18 inches in the row. This practice is indispen able to give the plants ample room on all sides to produce seeds, and cannot be successfully carried out when the crop is 3 or 4 months old because the roots by that time are so thick and tough that a disk or plo would not cut them. It is the writer's belief that the thickness of the stan on the Eastern Oregon dry lands has more to do with pollination than an other factor. In summer when the plants are in full bloom, evaporatio is intense and the crowded plants become more or less flaccid of tissue and this seems to have an effect upon the delicate blossom and it pollinizing mechanism (1). The writer tried to favour pollination by " tripp ing " the blossoms by running crosswise over the rows a light wooden rolle but with no great success, which he explained by the fact that the blossom are in all stages of development at any given time and only a few of the are just at the point for successful " tripping ".

The writer does not believe that planting the seed in hills 3 feet o more apart each way would be advisable. It would be more expensiv and difficult, the effect upon fertility would probably be less and harvestin would be harder.

Ordinarily three or four harrowings, followed by two or three cultiva tions with a corn cultivator, will be sufficient to maintain a mulch an destroy the weeds. The alfalfa should be clipped whenever weeds outgro it, or begin to ripen seed, or if mildew or other disease appears (hithert no sort of pest has ever been reported on alfalfa in Eastern Oregon It should also be clipped whenever it begins to blossom, as the formatio of seed during the first year would weaken the development of the plan The plant should be allowed to make a growth of 5 to 6 inches before th winter. The occurrence of dodder must be prevented by the usual means

During the second year the crop should be disked once or twice cross wise early in the spring. Later it may be cultivated with a harrow and sti later with a shovel cultivator.

(1) See *B.* Oct. 1914, No. 894. (*Ed.*).

In regions where the rainfall is scanty and the growing season short, he seed crop should be made from the first cutting. Under more favourable onditions a clipping of the crop should be made when it is 6 to 8 inches igh and the second cut left for seed, when all the plants will blossom at ne same time and mature the seed more uniformly.

Alfalfa for hay. — Where it is desired to grow alfalfa as a hay crop, may be seeded more thickly in the row, 3 lbs. per acre being ample. No inning should be done. In districts where the rainfall is 18 inches or ore, the rows may be made at 28 or even 21 inches apart, or double-drill ws 28 inches apart may be sown. In other respects the same methods cultivation should be followed as for seed production.

For pasturing, pigs prefer the Baltic alfalfa to the common variety, hich they do not touch before the former is pastured down to the stubs. he writer recommends dividing the field by means of moveable fencing. e advises also ploughing up the crop, in the dry-farming lands, at least very fifth year and putting the land under other crops.

The field pea. — The field pea is second only to alfalfa in importance r the dry lands. It is, however. indispensable to sow it at the proper me (March) so that it is matured by the time the summer dry weather ts in, and at the proper rate, that is 3 bushels per acre. The writer commends sowing in double drill rows 35 inches apart, and at least 4 ches deep. He considers the following varieties to be the best: New ealand Brown, or Carleton pea, the Cossack, the Grey Winter, and the amort. In several experiments carried out at Moro, at Burus and at etolius in 1912 and 1913 the first yielded from 14.9 to 22.4 bushels of y seed per acre; the second 15.2 to 26.36 bu.; the third 12.2 to 26.8 .; and the last 15.5 to 29.19 bushels per acre.

Considering that the market for field peas in the Northwest is a con- antly growing one and that the price is always good, averaging 2 ½ cents r pound, the best use for them is as a seed crop, for they are unquestion- ly more profitable than the wheat crop itself in the Eastern Oregon dry- rming region. Besides this it is an excellent food, being pastured off pigs or sheep.

Careful trials of the value of field peas for hogging-off have been made the farms of the Oregon Experiment Station, and have yielded the follow- g averages:

Initial weight of the pigs	1079 lbs.
Final » » »	1935 »
Total gain » »	856 »
Number of acres	4.56
Gain per acre in pounds	188.7
Value of gain per acre.	$ 15.00

With field pea seed at 3 cents per lb., the cost of producing an acre of as is as follows:

Ploughing.	$ 1.75
Harrowing 4 times	» 0.80
Seeding	» 0.30
Seed, 100 lbs.	» 3.—
Total	$ 5.85

The pigs are turned in when the peas begin to get too hard for tab use; water is supplied them and in 40 to 60 days they are ready for marke Before being turned into the peas, the pigs are kept on alfalfa and rap Any pigs that are small or not ready for market when the peas are finish may be put on maize or finished with wheat screenings or barley.

Field beans. — They may be profitably grown where irrigation not possible but where there is a rainfall of from 15 to 18 inches and frost from May to September inclusive. In Umatella County the yie of seed is about 800 lbs. per acre, which sells readily at 3 cents per lb. grow a crop of field beans would cost only $ 4 or $ 5 more per acre tha to summer-fallow the land, thus bringing a net profit of about $ 20 per acr at the same time leaving the soil in excellent shape for the following cr of wheat.

The best varieties for the Columbia Basin are the Red Mexican, whic is probably the hardiest and earliest maturing, and the Little White Nav which is almost equally hardy.

The writer next discusses the suitableness to Oregon of the followi Leguminosae: Soy beans, broad beans, hairy vetch (*Vicia villosa*) an smooth vetch (*Vicia sativa*), clover, crimson clover, sweet clover, an Tangier peas.

Forage grasses. — Among the forage grasses tried by the Oreg Experiment Station the most successful were slender wheat-grass ($^3/_4$ a ton of hay per acre; good pasture), tall oat grass, smooth brome gras Kursk millet, Sudan grass (at the Moro Station in 1912, 1.08 tons per ac of good hay). On the whole the best grasses so far found cannot be recon mended for Eastern Oregon where the rainfall is not over 12 inches.

Sorghums. — With the most cold-resistant sorghums, at the Mo Station, fairly successful results have been obtained as a forage crop (yiel of from 1 to 2 tons per acre), but the grain does not mature sufficientl

The writer suggests that one of the best uses of this crop is for plan ing in long strips of five or six rows at intervals of 500 to 1000 yards cros wise to the prevailing wind as an effective wind-break, in fields where s blowing occurs.

37 – **An Investigation of the Diastase of Alfalfa and the Effect of Rapid Curi upon the Food Value of Alfalfa.** — SHUEY, R. C. (University of Kansas) in *Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 11, pp. 910-919. East Pa., November 1914.

The diastatic activity of alfalfa was determined under various con tions of plant growth and curing; it was found that quality in hay judged by colour and smell was always associated with high diastatic ac vity and that such hays usually contained a larger amount of solu digestible constituents.

The diastatic activity was increased by darkness and warmth, a was greater in young plants than in old ones. Drying the plant at tem ratures above 50° C. in a humid atmosphere decreased the diastatic ac vity, but if the drying was carried out in a current of air with a gradua increasing temperature, the activity was increased. Consequently,

eld curing, the light and humidity are detrimental to the making of good ay, more especially if the humidity is increased by rain during the process, hilst curing by artificial heat under proper conditions of ventilation and emperature yielded hay of the very best quality. The writer estimates nat the cost of artificial curing would be more than compensated by avoid- ng the losses to which hay is exposed during field curing.

s – **The Improvement in Cotton Cultivation in Sicily.** – Tropea, C., in *Nuovi Annali di Agricoltura Siciliana*, Year III, Series VI, Part 3, pp. 149-175. Palermo, September 1914.

Of the numerous varieties of cotton studied by the writer during several ears of experiments, the variety Mitafifi has given the best results from very point of view. Experiments conducted during 1914 and demonstra- on plots have shown that :

1. Mitafifi is more drought-resistant than even the Sicilian varieties.

2. The growing-period of this variety is such that it can be picked t the same time as the Sicilian varieties when it is manured and topped ccording to the rules determined in the experiments.

3. The acclimatisation of this variety is easy and the seed may be sown n the same plot from which it was harvested without fear of degeneration the following year as is the case with other varieties.

4. The absence of easily contagious diseases transmissible through the eed gives Mitafifi an advantage over almost all American varieties of otton.

5. In yield it is at least equal to the varieties grown in Sicily.

6. The maturation of the capsules is much more complete.

7. The quality of the fibre is excellent, as shown by the fact that realises higher prices on the market than the average of Sicilian cottons,

8. The seed, being naked and richer in oil by some 4 per cent than ne native varieties, realises a much better price.

There is therefore ample justification for the preference given to gyptian cotton and for the intention of the director of the experiment elds to grow it instead of the local varieties in Sicily with a view to a more tional and extensive cultivation of cotton.

Experiment plots have been established in 10 localities in the island : ne near Lo Zucco, two near Terranova, four near Sciacca, one near Ter- ini, one near Cerda and one near Vittoria. Before distribution the seed as submitted to germination tests. The plots at Terranova and Sciacca ere each divided into two sections, with the object of comparing Mitafifi ith local cottons. To show the effect of proper cultivation it was only ecessary to compare the experiment plots with the average Sicilian crops, hich were very inferior in growth, drought resistance and quality of pro- uct. The yield of the Mitafifi on plots at Terranova and Sciacca is about 970 lbs. per acre, whilst that of Termini, Piano Lungo and Vittoria veraged 755 lbs. per acre and that of Lo Zucco 935 lbs. per acre. In each se the harvest was of excellent quality. Acclimatisation has effected nly one slight change, namely the loss of the characteristic grey-brown olour; but this does not diminish its commercial value.

Owing to the mild climate, Mitafifi can survive the winter and become a biennial if the stems are cut down to the base ; this has been done successfully at Terranova and it will be useful to determine the cultural advantages, since the introduction of this practice would result not only in economies in the preparation of the soil and in seeding, but also in promoting a more extensive root system, thus increasing resistance to drought and earliness. Trabut has already stated that such a method would be very useful in the destruction of parasites and give the plant greater vigour.

An examination of the results of the experiment plots and of two estimates of the cost of cultivation, one a maximum and the other a minimum, furnished by the itinerant lecturers of Girgenti and Syracuse, leads to the following conclusions : whilst the native cottons give a net profit of £2 2*s* per acre the profit from Mitafifi is £5 per acre ; further, since this Egyptian variety succeeds well even without irrigation, it is useful in rotation as a preparation for wheat, which gives a higher yield after cotton than after beans.

The experiments should be continued to see whether there are other varieties still better than Mitafifi, but in the meantime the propaganda of the experimental plots should be continued for developing the cultivation of cotton in Sicily, directing it towards rational methods and replacing the native varieties by Mitafifi.

39 – **New Productive aud Resistant Cotton obtained by Crossing aud Selection in Georgia, U. S. A.** — *The Country Gentleman*, Vol. LXXIX, No. 46, p. 1853. Philadelphia, November 14, 1914.

The new cotton, « Dix-Afifi », was obtained in Georgia by crossing Dixie on Afifi or Egyptian, the latter raised from seed that was imported direct from Egypt. Dix-Afifi was the outcome of careful selection, stalk selection and cross pollination carried on for five years, with the object of getting a heavy yielding, high-grade upland cotton of long staple and resistant to wilt and to boll-weevil.

The staple of the new hybrid runs from an inch and an eighth to an inch and a quarter. This cotton has been planted in the vicinity of Vicksburg, Mississippi, by the Georgia State Board of Entomology in cooperation with the Federal Department of Agriculture, and yielded 1900 lb. of seed cotton to the acre, notwithstanding the fact that the boll-weevil is rampant in the Vicksburg section. The hybrid is wilt-resistant and it withstands boll-rot much better than most of the long-staple upland varieties.

Triumph was the nearest variety to Dix-Afifi in yield tests. The former yielded 1375 lb. to the acre against Dix-Afifi's 1900 lb. Triumph is worth 12 cents while Dix-Afifi fetched from 14 to 17 ½ cents.

40 – **Calcium Cyanamide as a Manure for Olives.** — MORETTINI, A., in *Bollettino della Società Nazionale degli Olivicoltori*, Year VIII, No. 8, pp. 109-117. Rome, 1914.

There is still considerable uncertainty concerning the use of calcium cyanamide as a manure for olives and fruit trees, as seen in the lack of agree-

ment in the results obtained by several workers. (1). Realising the importance of the subject, the writer began a series of experiments in 1911 at the Royal Agricultural Institute at Perugia, at first with various fruit trees and later with olives alone. The following results were obtained from four series of experiments on olives, one of which was on a large scale in a private plantation.

The trees were divided into five groups of 12 each ; the whole 60 trees received a basal manuring of 12 cwt. of mineral superphosphate and 3 cwt. of sulphate of potash ; in each group increasing quantities of nitrogenous manure were given as follows : trees 1-2, 400 gms. (14 oz.) per tree ; 3-4, 800 gms. (1 lb. 12 oz.) per tree ; 5-6, 1200 gms. (2 lbs. 11 oz.) per tree ; 7-8, 1500 gms. (3 lbs. 5 oz.) per tree ; 9-10, 2000 gms. (4 lbs. 7 oz.) per tree ; 11-12, 2500 gms. (5 lbs. 9 oz.) per tree. The nitrogenous manure applied and the results obtained in each case are given in the following table.

Group	Manure	Yield of olives in 1912	Prunings, April 1913	Yield of olives Nov. 22, 1913	Prunings, April 1914
		lbs.	lbs.	lbs.	lbs.
A.	Calcium cyanamide, granular (1911). .	35.6	324	—	—
	Nitrate of soda	—	—	64	291
B.	Calcium cyanamide in powder (oiled) . .	192.8	372	255	313
C.	Sulphate of ammonia	202.8	395	266	271
D.	Nitrate of soda	202.4	267	332	317
E.	Control.	150.3	357	163	328

The conclusions drawn from these results are as follows :

1. In fairly heavy marls, cyanamide as prepared at present (in powder), applied as a top-dressing and lightly dug in, is not injurious to olives even in quantities of 5 ½ lbs. per tree.

2. In the granular form, however, as previously sold, cyanamide applied in the same manner on the same soil is injurious, even at the rate of 14 oz. per tree.

3. When stored in a dry place from one year to another its fertilising value is diminished, but it does not become injurious.

4. In these particular soils the manure gives good results when applied during the winter and early spring (April).

5. The fertilising action of cyanamide on olives is very pronounced ; but the order of efficiency of the three nitrogenous manures is as follows : nitrate of soda, sulphate of ammonia, cyanamide.

6. From an economic point of view the above order would be changed and cyanamide would come before the other nitrogenous manures for olives, as for field crops, on these soils.

(1) See *B.* March 1912, No. 491. *(Ed.).*

41 – **The Trade in Palm Kernels.** — *Bulletin of the Imperial Institute*, Vol. XII, No 3, pp. 458-464. London, July-September 1914.

The two chief products obtained from the West African oil palm are palm oil and palm kernels. The former is obtained from the pericarp of the fruit. The quantities and values of the exports of palm kernels in 1912 from each of the chief producing countries in West Africa are shown in the following table :

	Quantities — tons	Values — £
Gambia	445	6 518
Gold Coast	14 629	205 365
Nigeria	184 624	2 797 411
Sierra Leone	50 751	793 178
Dahomey	36 708	535 937
Gaboon	354	4 671
French Guinea	5 054	41 079
Ivory Coast	6 692	70 710
Senegal	1 736	28 221
Belgian Congo	—	110 835
Kamerum	15 742	220 300
Togoland	11 456	168 978

Almost all the palm kernels exported from the British possessions in West Africa are sent to Hamburg. In 1913, 241 961 tons of these kernels, worth £ 5 233 250, were landed at Hamburg. They are used as a source of oil ; their price during 1914 was about £18 per ton. The kernels yield from 46 to 53 per cent. of oil, which is extracted either by pressure or by solvents. It is used for the preparation of edible fats and in the industries ; its price in the United Kingdom is from £36 5*s* to £36 15*s* per ton.

The cake seems to be very suitable for young pigs and for milch cows. For feeding purposes some prefer the cake obtained by pressure, as in that extracted by solvents all the oil is taken out. The following figures give the percentage composition of the cake according to the method of preparation :

	Water	Crude protein	Fat	Carbo-hydrates	Crude fibre	Ash	Value
Expressed cake	9.7	17.7	8.6	36.2	23.8	4.0	£ 6.8 to £ 6.12 per ton
Extracted cake	10.9	18.7	1.6	39.1	25.4	4.3	—

In 1912, 133 816 metric tons of palm-kernel meal or cake were made in Germany, of which 120 000 m. tons were consumed in the country.

42 – **A New Oil-Seed from South America.** — JESSON, ENID M., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 9, pp. 333-334. London, 1914.

Recently a shipment of the seeds of *Osteophloeum platyspermum* Warb. (*Myristica platysperma* Spruce) has been received at Liverpool. The tree is a native of North-West Brazil, where it was discovered by Spruce in 1852 in the forest near Panuré on the river Uaupes, a tributary of the Rio Negro.

The fat obtained from these seeds on extraction with petroleum ether is white and crystalline, and possesses a very slight smell. The kernels of one sample yielded 55.2 per cent of fat, the constants of which are given below :

Melting point	43° C.
Solidifying point	39° C.
Saponification value	240.2 mmg.
Iodine value (Wijs)	6.3 per cent.
Refractive index at 40° C (Zeiss Butyro-refractometer)	36.9

The oil was also found to possess 5.3 per cent of free fatty acids (calculated as oleic acid).

The fruits are globose or elliptic, about 2 ½ cm. long and 1 ½ cm. high, the dehiscence taking place in the median plane, into two valves. The pericarp, is about 1 mm. thick; this encloses the seed, the testa of which is made up of three layers, the outer, yellowish and more or less scaly, the second brown and rugose, and the inner one a thin brown skin covering the greenish-white endosperm. The inner shell (middle testa) is brittle, and presents little or no difficulty in crushing and separating.

43 – **Opening up Young Rubber: Basal V and Single Quarter Systems of Tapping** (1). — SPRING, F. L., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, No. 9, pp. 230-235. Kuala Lumpur, F. M. S.

RUBBER, GUM AND RESIN PLANTS

The object of the experiment was to compare the basal V system of tapping with that of the Single Quarter (half herring-bone), and to find out the relative amount of rubber obtained from a varying number of cuts on the Single Quarter system. The number of trees in each plot is 100; they are planted at 12 ½ × 25 feet apart and had not been tapped previous to the commencement of the experiment. They were all in identical conditions and their girth was practically the same ranging from 21.3 to 22.6 inches. Plots 1,2 and 3 were tapped on the half herring-bone system, plot 4 on the basal V system ; all the plots were tapped daily, and the cuts were twenty to the inch. The trees in plots 1 and 4 were given one cut at 18 inches from the ground ; those in plot 2, two cuts, 18 inches apart and in plot 3, three cuts, 18 inches apart. The total yields for eleven months were as follows :

(1) See *B.* Dec. 1914, No. 1118. (*Ed.*).

No. of plot	Total rubber	
	lb.	oz.
1	152	0 ½
2	220	10 ½
3	180	3 ½
4	304	1

The greater yield given by the basal V during the first year is likely to be maintained in the second year, with a similar V on the opposite side of the tree. During the 3rd and 4th years, in the case of the V it will be necessary to resort to a top V, when there is a possibility of a reduction when compared with the same time of tapping on Single Quarters, but over the period of the four years it seems probable that the difference will be in favour of the V. Previous experiments have shown that commencing with a top V 36 inches from the ground and tapping for two years, or until half the circumference of bark is removed, a much larger amount of rubber is obtained than from 2 years' tapping on the Single Quarter system with two cuts.

The writer favours the Basal V, if it is intended to continue on this system, in which case it might be preferable to place the V at 24 inches from the latex spout, and afterwards a similar V on the opposite side of the tree; this would allow of a shorter period for working on the top Vs.

SUGAR CROPS

44 – **Statistical Data Concerning the Java Sugar Industry during the Last Twenty-five Years.** — GEERLIGS PRINSEN, H. C., in *The International Sugar Journal*, Vol. XVI, No. 187, pp. 325-327. London, July 1914.

The following data are taken from a series of tables drawn up by the writer for each year: 1) between 1893 and 1914 inclusive for the area under sugarcane in Java; 2) between 1889 and 1913 for the production of sugar in lbs. per acre; 3) between 1889 and 1913 for the total production of sugar in Java; 4) between 1893 and 1913 for the average yield of sugar from 100 parts of cane (calculated on the basis of 96° polarization); 5) between 1899 and 1913 for the average manufacturing loss of sugar in 100 parts of sugar in cane sustained in the factories; 6) between 1889 and 1913 for the average prices of Java refining crystals (96.5° polarization), packed in bags or baskets delivered at the buyers' scales at the Java ports; 7) between 1900 and 1913 for the average selling price of Java sugar of all assortments, together with the actual cost subdivided into payments to natives and others; 8) between 1900 and 1913 for the monetary value of the Java sugar crop lying at sea coast in the buyers' warehouses, together with the net cost subdivided into payments to natives for wages and deliveries and to others.

In tables 1 and 3 an almost perfectly regular increase is observed and in table 2, an increase, constant on the whole, but not so regular. In table 6 there is regular decrease from 1889 to 1902, then an almost regular increase from 1903 to 1912. In table 7 the decrease is regular from 1900 to 1902 and the increase constant after 1903.

No. of table	Unit	In first year of period under examination	In last year of period under examination	Maximum observed in period under examination	Minimum observed in period under examination
1	acres	128 500 (1893)	366 000 (1914)	366 000 (1914)	128 500 (1893)
2	lbs. per acre. .	6 832 (1889)	9 009 (1913)	9 636 (1911)	6 299 (1894)
3	tons (2240 lbs.).	327 753 (1889)	1 442 884 (1913)	1 443 465 (1911)	327 753 (1889)
4	percentage . .	10.98 (1893)	9.65 (1913)	10.98 (1893)	9.57 (1900)
5	» . .	19.42 (1899)	22.25 (1913)	22.25 (1913)	17.42 (1904)
6	shillings and pence per cwt.	15*s* 6*d* (1889)	9*s* 4*d* (1913)	15*s* 6*d* (1889)	6*s* 11*d* (1902)
7		9*s* 6 $\frac{1}{2}$ *d* (1900)	9*s* 10 $\frac{1}{2}$ *d* (1913)	11*s* 4*d* (1912)	6*s* 10 $\frac{1}{2}$ *d* (1902)
8	Millions of pounds sterling	6.95 (1900)	14.24 (1913)	15.48 (1912)	5.96 (1902)

Exports of sugar from Java during the year from May 1, 1912, *to April* 30 1913.

Country	Tons (2240 lbs.)
Europe	142 244
United States	40 673
Australia	92 261
China	210 699
British India.	461 845
Singapore	104 329
Japan	236 164

Or a total export of 1 288 215 tons, as against 846 213 tons in 1902-3 and 443 273 tons in 1892-3.

The average sale price as per Table 7 always left a net profit inclusive of interest on capital, except in 1902 when there was a loss of 9 $\frac{1}{2}$*d* per cwt. The greatest profit was made in 1911, when it amounted to 2*s* 5 *d* per cwt. on an average selling price of 10*s* 11*d* per cwt. of sugar of all assortments.

45 – **The British Beet Sugar Industry. Considerations and Suggestions.** — SAWYER, WALTER E., in *The International Sugar Journal*, Vol. XVI, No. 187, pp. 305-308 1 fig. London, July 1914.

The only sugar factory actually in existence in England is the one constructed in 1912 at Cantley (Norfolk) by the Anglo-Netherland Sugar Corporation Limited. In the contract drawn up by it with the growers for the season 1913-14, it offers 25*s* per ton for clean beets where the railway rate does not exceed 2*s* 6*d* per ton, longer distances in proportion. The beets are paid on tonnage only, irrespective of sugar content. The seed (Kleinwanzleben) is provided by the factory, which purchases it in Germany. Farmyard manure is permitted, but must be applied by the 28th February. According to the method recommended by Prof. J. PH. WAGNER of Ettelbrück, the rows are drilled 14 inches apart and singled 10 inches from plant to plant.

Experiments carried out on a large scale by the National Sugar Beet Association in more than 100 centres in 1912, yielded an average of 12 ½ tons of washed, crowned and topped beets per acre, while in experiments conducted under the auspices of the Deutsche Landwirtschafts-Gesellschaft in Germany (all absolutely under expert control and under the best agricultural conditions the average return for clean roots was 14 tons to the acre for the years 1907-8-9.

In 1913 the Sugar-Beet Growers' Society grew some 3000 acres of sugar-beets spread over Norfolk and Suffolk and sold the produce at 22 *s* per ton delivered (factory weight) to the Cantley Factory.

This was an educational experiment on a large scale on behalf of the Government, supported in part by a grant to the above society.

46 – **Note on the Sugar-Maple.** — Gallois, M. (Inspeetor of Waters and Forests), in *Bulletin Mensuel de l'Office de Renseignements Agricoles*, Year XIII, No. 5, pp. 596-600. Paris, 1914.

Generalities. — After giving certain biological data on the sugar-maple (*Acer saccharum*) the writer deals with its importance from the point of view of sugar production, giving details collected during a special tour in America. This tree is only exploited for sugar in Canada and the United States. The collection of the juice and the manufacture of sugar and syrup are carried out in a very simple manner. In early spring the trunk of the tree is pierced with a hole about half an inch in diameter and 2 inches in depth, into which a tube is placed and the sap collected in a vessel suspended below. The syrup or sugar is generally obtained by simply boiling down the sap in a wooden hut erected in the plantation. The sap is conveyed in casks or other vessels or by a system of pipes.

Maple-sugar industry. — At present maple sugar and syrup are no longer used commercially except by confectioners. A considerable part of the products is consumed by the proprietors themselves as substitutes for sugar and in confectionery and jam making.

In 1910 the production of maple syrup was 4 106 500 gallons and of sugar 14 060 000 lbs. and, considering 7 ½ lbs. of sugar to a gallon of syrup, in the United States the total sugar would be 44 858 000 lbs. valued at $5 177 809, and in Canada approximately 20 000 000 lbs. valued at $2 000 000.

Since these are the only countries producing maple sugar, the total world's production may be considered as 64 858 000 lbs. valued at $7 177 809 or about 11 cents per lb.

Although the consumption of maple-sugar does not diminish, the production is gradually decreasing, thus showing that its value is greatly appreciated by the public and that adulteration is practised to a considerable extent. The producers are demanding severe protective measures and it is very probable that they will be granted.

Exports. — In 1912 Canada exported 1 370 930 lbs. of sugar or its equivalent as syrup, valued at $115 691, of which 38 968 lbs. valued at $4392 went to England and almost all the rest to the United States. No exact figures are available for the exports from the United States. The future

of the industry is very favourable for both Canada and the United States, provided the inferior products and substitutes can be eliminated. With a view to developing this trade with Great Britain, a syndicate has been formed in the United States and it is hoped that the English market will absorb several thousands of tons of products of first quality.

Returns from a maple plantation. — The yield of sap of a single tree is very variable according to the climatic conditions. Thus one tree may yield from 5 to 40 gallons of sap, and the percentage of sugar, which averages 2 to 3 per cent, may rise to 5 or 10 per cent. The yield of sugar of a single tree may be from 1 to 7 lbs. per season. Generally the yield of 100 trees averages 30 to 40 gallons of syrup or 200 to 300 lbs. of sugar. In the cost of harvesting there is also considerable variation. In large plantations the cost varies from 45 to 75 cents per gallon of syrup and from 5 to 8 cents. per lb. of sugar. Similar variations occur also in the selling price, which varies from 7 to 25 cents per lb. of sugar and from $1 to $2 per gallon of syrup. Carefully prepared products realise an average price of $1.25 per gallon of syrup and 12 cents per lb. of sugar. The net profit is therefore about 5 cents per lb. of sugar and 50 cents per gallon of syrup. Considering the climatic conditions and various other factors which may act unfavourably on the yield of juice, it is safer to fix the annual revenue at 7 cents per tree per annum. From this it follows that the returns from one acre containing 100 to 120 trees will be about $8 and even $12 to 15 if the work is done by the owner himself.

The writer strongly recommends the introduction of this tree into France, as on account of its beauty and the value of its timber it would supersede many other forest trees cultivated in Europe. Even supposing it did not succeed as a source of sugar, which is improbable, the planters would have no cause to regret the expense owing to the valuable timber produced. Assuming that the tree prefers a soil which remains covered with snow for a considerable time in the spring, suitable experimental areas could be found in the Alps, the Jura, Haut Bugey, etc.

47 – **Coffee from Wild Trees in Angola.** — Mc Bride, Harry A. (Boma, Belgian Congo) in *The Tea and Coffee Trade Journal*, Vol. XXVII, No. 5, p. 419. New York, November 1914.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINA CROPS

Coffee is Angola's second product, and there are vast areas of it growing wild. It is gathered and sold by the natives, and there are several European companies engaged in the coffee business. The chief coffee belt extends from the Quanza River northward to the Congo at an altitude of 1500 to 2500 feet. In the Cazengo Valley the wild trees are so thick that the only operation necessary to the plantation owner is thinning out. When the trees become too tall they are simple cut off about 2 feet above ground and new shoots appear from the trunks the following season.

The most extensive coffee plantations owned by the Companhia Agricola de Cazengo produced in 1913, a record year, nearly 1500 tons, which is more than all the other plantations combined.

The coffee harvest begins in June, and it is often necessary for the Government to lend native soldiers to the planters to aid in harvesting

as the labour supply is insufficient. After picking, the beans are dried in the sun for 14 to 40 days, according to the weather; they are then hulled and winnowed.

A condition adversely affecting the trade has been the low price that Angola coffee commands on European markets. The cost of production per arroba (33 lb.) on the Cazengo plantation is $1.23, while Lisbon market quotations average $1.50, having only 27 cents for railway transport to Loanda and ocean freight to Lisbon. It has been unprofitable to ship to other markets on account of the preferential export duties. The recent Brazilian coffee valorization scheme has somewhat alleviated these conditions, and the Cazengo and Golungo districts have benefited greatly thereby. A part of the product is now shipped to Hamburg, where it is known as the "Cazengo brand". Next to Mocha, the Cazengo coffee is the smallest bean found on European markets.

48 – **Manuring of Coffee at São Paulo, Brazil.** — I. Bemesting van Koffielanden in São Paulo. — *De Indische Mercur*, Year XXXVII, No. 47, p. 997. Amsterdam, November 27, 1914. — II. J. D. Una experiencia de adubação caféeira. — *O Fazendeiro*, Year VII, No. 7, pp. 217-218 + 2 figs. S. Paulo, July 1914.

1. *General conditions.* — The manure most commonly used for coffee at S. Paulo consists of stable dung, previously limed and mixed with coffee hulls. When these materials are scarce, poudrette and guano are used. It may be assumed that a three-year-old coffee plant requires 3-4 gms. of lime, 1.2 gms. of magnesia, 6.3 of potash, 0.7 of P_2O_5. The stable manure used contains in 1000 parts by weight: 3.3 of lime, 3 of magnesia, 0.2 of potash, 4 of P_2O_5; the hulls contain per 1000: 3.9 of lime, 1.7 of magnesia, 20.7 of potash and 1.7 of P_2O_5. The poudrette employed, in default of the preceding manures, contains 6 per cent of nitrogen, 2 per cent of phosphoric acid and 2 per cent of potash; the guano used in the best farms contains 4.5 per cent of nitrogen, 10.5 per cent of phosphoric acid, and 4.5 per cent of potash; their price delivered at Santos is respectively 7 *s* 6 *d* and 6 *s* 6 *d* per cwt. First of all 16 to 24 cwt. of lime per acre are spread between the rows, then half a shovelful of stable manure and 22 lbs. of macerated coffee hulls to every four plants; in the case of new plantations only the lime is given.

2. *An experiment with artificials on coffee.* — Opinions differ as to the advantage of using artificials for coffee. Nevertheless the writer has conducted for the last 8 years several experiments on chemical manuring in several plantations, in view of the fact that the question of manuring coffee is becoming more urgent on account of the insufficient quantities of stable manure produced, which allow of its being used only once in 10 to 20 years. The following results were obtained in a plantation 50 years old which was completely impoverished. The experiment was begun in 1910; in the manured plot each plant was given 1.2 lbs. of a mixed fertilizer containing 75 gms. of potash, 52 gms. of phosphoric acid and 28 gms. of nitrogen; the unmanured plot was given a single dressing in 1912 of stable manure with coffee hulls.

Yield of 966 coffee plants with and without artificials.

Year	Manured			Unmanured		
	Bushels	Cwt.	Bushels per cwt.	Bushels	Cwt.	Bushels per cwt.
1912	97.62	10.37	9.41	56.38	4.72	11.94
1913	90.06	11.55	7.80	59.81	6.78	8.81
Total and average .	187.68	21.92	8.56	116.19	11.50	10.10

The difference in the bushel-weights of the manured and unmanured coffee should particularly be noticed.

49 – **Investigations on the Manufacture of Tea.**— SAWAMURA, S., in *The Bulletin of the Imperial Central Agricultural Experiment Station, Japan*, Vol. II, No. 1, pp. 75-83. Nishigahara, Tokio, March 1914.

I. — *Effect of steaming on the activity of the enzymes of tea leaves.*

Tea leaves contain an abundance of oxidising enzymes which produce a black colour during the fermentation. The destruction of these oxidising enzymes by steaming results in a green tea.

Among other enzymes in tea leaves is diastase, which may be extracted in 40 % alcohol and precipitated in ether alcohol.

By subjecting various samples of tea to steam for different periods and testing for oxydase, the writer found that the oxydase loses its activity when steamed for 30 seconds, but retains its diastatic power. It is therefore very probable that enzymatic action takes place in the first stage of rolling tea leaves and that the production of a fine aroma is due to this.

II. — *Effect of rolling on the solubility of tea.*

The object of rolling the leaves in the manufacture of green tea has not yet been determined. It may be to give the tea a fine shape, or to press out the juice to accelerate drying, or to break the cells in order to increase the solubility.

Samples of green tea were prepared with and without rolling and the qualities of their infusions compared.

The infusion of the rolled tea was of a deeper colour, and had a stronger flavour and better taste than that of the unrolled tea.

This difference was also apparent in the amounts of soluble matter in the infusions, which were as follows;

	Percentages of the total amounts of each constituent in the original samples	
	unrolled (Tencha)	rolled (Gyokuro)
Dry matter	23.021	31.656
Nitrogen	31.869	34.427
Tannin	8.216	34.374
Thein	63.559	79.453
Ash	64.083	63.708

These differences in the amounts of soluble matter in the infusions of rolled and unrolled tea disappear when the samples are powdered before extraction. Hence it is concluded that rolling has the effect of increasing easily soluble matter by crushing the cells and pressing out the juice so that it dries on the surface of the leaves.

III. *Effect of firing on the chemical composition of tea.*

Refiring improves the flavour and colour of both green and black tea. Experiments were made with samples of tea fired at different temperatures for different periods. It was found that the optimum condition for firing green tea is a temperature of 70° C for one hour and for black tea a temperature of 80° C. Higher temperatures spoil both flavour and colour. The solubility increases slightly at moderate temperatures, but at higher temperatures the total soluble substance and tannin decrease remarkably. The tannin is destroyed by oxidation and a decrease of thein takes place owing to volatilisation.

50 – **The Cultivation of Cacao in Togoland.** — *Gordian*, Year XX, No. 470, pp. 7664-7665. Hamburg, November 30, 1914.

Cacao has been cultivated in Togoland for a considerable time. The exports in 1900 were 59 lbs., in 1908 190 685 lbs., and in 1913 they reached 736 945 lbs. During the first four months of 1914 they reached 601 902 lbs. or double the quantity during the corresponding period last year.

The following information was furnished by the agricultural agent who until a few months ago was in the Government service in the colony. The chief districts of cacao cultivation in Togo are : 1) Buem, with the lesser mountain ranges, Kunja towards the south, Koroko towards the north, and Akamansu and Kagjebi towards the west near Pampavüe; 2) the wooded region near Amedschovhe with Logba, Leglebi, Woadse, Kpewe and the eastern spurs of Amedschovhe. It is also cultivated, but on a less extended area, in some parts of the western slopes of the Togo mountains (near Kitschibo, Badu, Kpete and Baglo), in some parts of the eastern slope (near Ele) and here and there in the districts of Misahöhe, Kete-Kratschi and Atakpam.

The best soils for this crop, deep and fresh, are those situated near Amedschovhe. The depth of these lands is of special importance to the colony, as the rainfall in the zones where cacao can be cultivated averages 1500 mm. (60 inches) with a maximum of 1800 mm. (72 inches). The cultivation is almost entirely in the hands of the natives. The seeds are

sown in nurseries and transplanting is done at the beginning of the rainy season.

As catch crops " taro " (*Colocasia antiquorum*) and even rice are grown with the young cacao plants. The care of the young trees and weeding often leave much to be desired. The control of pests is unknown, so that the yield per tree is not very high. The drying of the seeds and fermentation are also often carried out very inperfectly. However, the native is ready to accept advice and there is a prospect of much improvement in this cultivation.

51 – **Production and Consumption of Tobacco in France in 1912.** — *Ministère de l'Agriculture, Direction de l'Agriculture, Bulletin de l'Office des Renseignements Agricoles*, Year XIII, No. 7, pp. 801-803. Paris, 1914.

The following data are published by the General Direction of the State Factories. The average rate of consumption per head was, in 1912, 38.67 ounces, of which 4.19 oz. was snuff and 34.48 oz. other tobaccos. The total sum spent in tobacco amounted to £22 798 120, or 11*s* 7*d* per inhabitant.

The growing of tobacco is authorized in 28 departments ; its importance is shown by Table I.

In Algeria, the monopoly bought in 1912, 5 371 343 lb. of tobacco worth £57 858, at an average price of 2.58*d* per lb. The corresponding figures for 1911 were 8 561 253 lb., £86 935 and 2.44*d* average price per lb.

TABLE I.

		1912 crop delivered in 1913	1911 crop delivered in 1912
Number of planters		47 141	47 520
Number of acres under tobacco		36 634	36 597
Quantities delivered and paid for.	lb.	54 890 307	41 904 234
Values of above	£	1 077 140	816 303
Accessory expenses	£	743	637
Average price per lb.	*d*	4.71	4.66
Yield per acre	lb.	1 485.91	1 135.45
Value of yield per acre		£29 7*s* 11*d*	£22 6*s* 10*d*

52 – **Brazilian Carnauba Wax.** — FRAZER, ROBERT JR. (Consul, Bahia, Brazil) in *Daily Consular and Trade Reports*, Year 17, No. 252, p. 477. Washington, October 27 1914.

The vegetable wax obtained from the leaves of the carnauba palm is used in the manufacture of phonograph records, shoe polish, candles and other articles, and is an export of some importance from Brazil. Shipments from the whole country for the years 1910, 1911 and 1912 (the last

for which complete figures are available) were respectively 2681, 3214 and 3099 metrio tons.

Exports from the Bahia district to the United States alone in the last thre years were valued as follows: 1911, $13 690; 1912, $16 615; 1913, $14 501. The wax shipped from Bahia is brought from the interior, chiefly in the neighborhood of the San Francisco River. It is not prepared in large factories, but is worked on a small scale by individuals in the swampy lands where the palm grows; it is then collected by middlemen and sent to the port for shipment.

53 – **Beard Grasses used for Brush-making.** — *Ministère de l'Agriculture, Bulletin Mensuel de l'Office de Renseignements Agricoles*, Year XIII, No. 7, pp. 798-801. Paris, July 1914.

Beard grass includes many botanical species throughout Europe, growing spontaneously in damp soils and infesting cultivated land as a weed. It is extirpated by working the surface soil and by frequent harrowing, so as to bring the roots to the air to be dried up by the sun. On the other hand it can be made very useful: 1) for the protection of sandy lands (dunes etc.) which its roots bind together; 2) for making brushes out of its roots, dried and variously treated.

For the industry three kinds are employed:

1. Fine grass called *grenille.*
2. Tonking grass.
3. Mexican grass.

The first of these is supplied by *Chrysopogon gryllus*, both wild and cultivated in Italy and wild in Hungary. This is used for the manufacture of fine brushes for clothes or furniture. Another grass, *Andropogon ischaemum*, is also cultivated in Italy but is only used for coarser brushes.

Chrysopogon gryllus grows wild in damp and deep sandy soils in the lower valley of the Po, in Lombardy, Venetia and Emilia, while the best qualities prevail in the province of Treviso and in the meadows of Pordenone. It is cropped every three or four years from October to March in the following manner: first the upper sods are taken up, then the earth is lifted to a depth of about 12 inches so as to extract the roots without bruising them. After being combed, and then sorted with due regard to thickness and length, the roots are cleaned in water and afterwards dried in the sun. The drying has to be done with care not to let the bundles ferment, which would entail the loss of the valued natural colour. Next the dried roots are blanched by a 6 hours' exposure to the fumes of burning sulphur, and finally they are bound up in pressed packages.

For a subsequent crop it is only necessary to replace the turf sods, which will enable the plant to grow again, or it may also be reproduced by the seed which ripens in August or September.

Growers in Italy are few in number and they deal directly with the manufacturers. Italian grenille a few years ago was paid about 1*s* 3*d* a pound, but now it fetches 1*s* 9 ½*d* a pound; the price represents almost entirely the cost of preparation and manipulation. In view of the increase of price of the Italian grass, due to the rising cost of labour, an attempt

has been made to use less costly grasses. Thus that from Tonking has been tried, but found too fragile. The Mexican has done better and has an excellent appearance, but its quality is inferior to that of the Italian grass, to which however it is a serious competitor. For the manufacture of ordinary brushes in France the Mexican is almost exclusively used.

Growing without cultivation in its own country, this Mexican grass is remarkable for the extreme abundance of its root fibres. It can be taken up in any season, whenever the roots have acquired sufficient length. The harvesting is followed by washing in running water then by the sulphur fuming, drying and sorting processes, and finally it is pressed into bales of about 100 lbs. each.

It is principally exported to Havre and to Hamburg, but small quantities are also sent to Antwerp and to London. The growers do not deal directly with the consumers, but consign their produce to middlemen who find the customers for it. The Mexican beard grass now fetches between 7 ¼*d* and 11*d* per lb.

24 – **A Study of Variation in the Apple.** — YOUNG, W. J., in *The American Naturalist*, Vol. XLVIII, No. 574, pp. 595-635. Lancaster, Pa., October 1914. FRUIT GROWING

According to the principle of the *Law of the Optimum* (which states that for any given variety there is for each character a certain intensity of each essential factor of the environment, at which, other conditions remaining the same, that character reaches its highest development), a variety will appear at its best when grown in an environment the factors of which area as near as may be to the optimum intensity for all characters. Since the factors exert interacting influences, a certain harmonic balance amongst them is necessary to maintain the optimum conditions of environment. In the absence of this balance certain characters may fail to reach a proper degree of development while others develop to excess. Instances of this are the failure in quality and other respects of many of the best dessert varieties of apples when grown in Washington, and the difficulties of apple cultivation in the North-Western States. Thus, a study of variation in apples in relation to environmental factors is of considerable economic importance.

The 24 varieties used in this study originated in the east or middle west of North America, and have been selected and propagated because of their excellence and value when grown under those conditions of environment prevailing at their places of origin.

The results of the observations of the fruits of these varieties grown under different conditions are summarised according to the characters as follows :

1) *Size* : Thinning out may result in increased size owing to the larger amount of moisture available for each fruit. Temperature and length of season are of importance in determining, respectively, the rapidity of growth and degree of development attained. It must be noted, however, that the optimum for growth is not the best combination of factors for the development of certain other desirable characters.

2) *Form* : Some varieties remain quite constant in shape under different conditions, while others are much more plastic in this respect. The most frequent and conspicuous modification of form consists of the elongation of the axis of the fruit relative to the horizontal diameter. According to the writer this is due to a diminished circulation of the sap caused by changes in temperature, giving rise to an insufficient supply to provide for the simultaneous deveopment of the fleshy portion and elongation of the axis. Two or three weeks after blooming the form of the fruits becomes fixed and is not noticeably influenced by the moisture supply thereafter.

3) *Stem* : This is one of the most variable structures of the apple and it is difficult to associate such variations with the environment. In the case of some short-stemmed varieties unfavourable conditions generally result in longer stems than more favourable conditions of growth.

4) *Cavity* : The cavity varies chiefly in its depth and may be almost obliterated by elongation of the axis resulting from a deficient moisture supply.

5) *Calyx* : No modification of importance has been observed in the calyx-lobes of the fruit. In large fruit the calyx cup is larger and the lobes more separated than in small or poorly developed fruits.

6) *Basin* : The depth of the basin appears to depend upon the same factors as that of the cavity. Its width is associated with the form of the apple, a very constricted apex resulting in a narrow basin. A much furrowed basin results from a combination of factors unfavourable to the best development of the fruit.

7) *Skin* : Dry air and sunshine are favourable to the production of clear, smooth skin.

8) *Colour* : Light is the most important factor influencing colour in fruit. Too strong or too weak illumination may result in poorly coloured fruit, the best colour being developed under a condition of optimum intensity of the light. Temperature also appears to be a factor influencing the colour of some varieties, the direction of the effect varying with different varieties. There is no evidence to show that the composition of the soil has any definite influence on colour.

9) *Internal Structure* : The number of seeds may be an indication of the thoroughness of cross pollination and in most varieties the presence of one or more well developed seeds is a requisite to proper development of the fruit. Small or poorly developed fruits generally have a closed, axile core, whilst well grown specimens of the same varieties have a more open abaxile core. The carpels of poorly developed fruits are usually entire and smooth ; those of better grown fruit are more or less cleft and tufted.

10) *Flesh characters* : Texture depends upon the factors influencing growth. Excessive growth results in coarseness and a lack of coherence between the cells, resulting in mealiness ; under-developed fruit has hard flesh which becomes spongy rather than mellow on keeping. Juiciness is associated with the tendency of the cell walls to break rather than to

separate. Aroma is influenced by temperature and elevation, a cool climate and high elevation being favourable to its development. Flavour depends upon the kinds, amounts and relative proportions of the soluble solids, especially the balance between sugars and acids, which are dealt with under a separate head.

11) *Keeping quality*: The balance of factors favourable to good keeping quality does not differ much from that which produces the optimum development of the other characters of the fruit.

12) *Specific gravity*: Over-grown apples are generally of lower specific gravity; small undeveloped apples and juicy apples, if not over-grown, have a high specific gravity. Though some late keeping varieties have normally a low specific gravity, those lots of a given variety having a high specific gravity are usually the best keepers, while those of low specific gravity are of poor keeping quality. During storage the specific gravity of the apples decreases.

13) *Chemical composition*: Irrigation appears to reduce the quantity of soluble solids; otherwise there is no relation between environment and chemical composition.

The failure of many of the best varieties of apples to develop their characteristic quality when transplanted to new regions is due to a lack of balance among the environmental factors. It is therefore necessary to carry out the work of selection and origination of new varieties in the locality where they are required.

55 – **Fruit Culture at Baghdad.** — POPENOE, F. W., in *The Gardener's Chronicle*, Vol. LVI, No. 1449, pp. 229-230. London, October 3, 1914.

The first four-fifths of the distance from Bassora to Baghdad up the Tigris valley are a great barren plain varied only occasionally by some clusters of palms on the river bank. The last fifth is a region of date plantations interspersed with orange, pomegranate and other fruits. The fringe of cultivation which borders the Tigris for nearly twenty miles on either side of Baghdad extends right into the city itself, in which are to be seen the only irrigated gardens. The lack of canals of any length and the consequent difficulty of obtaining water prohibit the culture of practically anything but the palm which is met with everywhere. It has been roughly estimated that there are in the district contiguous to Baghdad, one million palms. The plantations vary in size from a few acres or a few trees to immense properties. While most of the large plantations belong to Turks, many of them are still owned by wealthy Arabs. Water is drawn from the river by means of the primitive "kirid", which consists of a bullock-skin bag raised and lowered by means of bullocks or horses. A European firm has introduced oil engines in a few plantations. No manure is used.

With the exception of the famous Khalesh dates, produced in the province of Hasa in Eastern Arabia, the dates of Baghdad are the finest in the Persian Gulf region. A very large proportion of all the varieties cultivated are of excellent quality; the choicest varieties, however, are the rarest and are never to be obtained in the bazaars.

Zahidi is the most extensively grown of all varieties, being extremely productive: the fruit can be sold either fresh (Zahidi Kursi) or dry (Zahidi Yabis). Next in popularity comes Khustawi, an excellent soft date, rather smaller in size, but of excellent, rich flavour. The best varieties are the Sukkari, Maktum, Tabirzal and Asharasi, a large dry date.

Next in importance among commercial fruits comes the orange. Baghdad oranges are famous throughout the Persian Gulf. Oranges are grown as subsidiary crops under the date palms, chiefly with the object of giving the trees some protection against the occasional sharp frosts of winter. Most of the trees are seedlings; nevertheless the fruit is exceptionally uniform in character, practically the only variation being in size ; they are brightly coloured and thin-skinned, with few seeds and abundant juice of excellent flavour. The Arabs call them " portugal ". Lemons, sweet limes, mandarins and citrons are also grown. The varieties of lemons are rather good; the varieties of the other citrus fruit seem to be quite up to the standard of other countries, notwithstanding the Arab's lack of interest in horticulture.

Of the pomegranate, a number of varieties exist, though it is doubtful if any are as fine flavoured as the Masqat pomegranate. Neither do they show any tendency to become seedless, as is claimed for some varieties both in southern Spain and in Afghanistan. The Salimi variety is considered the best; Ragawi, Halu, Aswad and Amlasi are other varieties. The best pomegranates are six inches in diameter and are sold in the bazaars at three or four pence each.

Among minor fruits, grapes, figs, mulberries, apples, plums, peaches, apricots and jujubes are grown; none, however, extensively. Six varieties of apples are known in Baghdad. Peaches are of inferior varieties and so are the apricots and plums, so that choice foreign varieties might be profitably introduced, all the more so as the conditions of climate, abundant water supply and freedom from insect pests render Baghdad pre-eminently suited to fruit culture.

FORESTRY

56 – **The Trees of the Alföld in Hungary** (1). — Bernátsky, Jenö, in *Erdészeti Kisérletek*, Year XVI, No. 3, pp. 130-180 + 14 figs. Selmeczbánya, 1914.

The question of the afforestation of the Alföld, or Great Hungarian Plain, is of high importance from the economic and sylvicultural points of view. Hungarian foresters have obtained very good results in the fixing of the sandy parts of the Alföld by sowing *Robinia pseudacacia*. But as the Plain presents conditions of great diversity, it is essential to determine what other species can be used for the reafforestation of the denuded areas. On black soils containing a fair amount of clay or limestone, oaks will no doubt do best ; but on the extensive alcaline lands neither oak nor robinia can succeed.

The writer has undertaken the collection of physiological and ecological information on all the woody plants of the Alföld, wild and planted.

(1) See also original article: Schmidt, " The Present Condition of Forestry in Hungary ". — *B.* Nov. 1914, pp. 1391-1400. *(Ed.)*

which are of importance for forestry or for ornament. It is well known that the tree vegetation of the Alföld differs from that of Western Europe, as well as from those of the Alps and Carpathians. From the writer's investigations it appears that many of the species now growing wild under the climate of the Alföld can form woods ; the presence of these species is good evidence that the Alföld has never been without woods, and indeed extracts from Tagány's documents (Budapest, 1896) on Hungarian forestry show that even 700 years ago there were woods of economic importance in the Plain.

The following is a summary of the species growing in the Alföld.

Juniper (*Juniperus communis*). — This is the only Conifer growing wild in the Plain. It grows on the sandy soils of Pest County and of the Déliblát steppes ; in some places on the sandhills it forms dense thickets of great extent. In these thickets its trunk reaches a fair height and its growth resembles that of spruce. It is an important element in the fixing of the shifting sandhills. At one time it was used for vine posts, but since juniper berries have come to be a valuable product cutting has been prohibited. The rental for berry-picking brings in over £100 a year, and the average crop of berries is 70 to 90 tons. As junipers are useful as shelter woods, the State Forestry Administration does not allow any kind of cutting.

Red cedar (*Juniperus virginiana* L.) — In parks on rich soil, as at Versecz, Vadászerdö and Gödöllö, this tree grows well. As the wood is valuable, planting is to be recommended. For some years Teodorovits has been making trial plantings at Királyhalom, in places in which robinia is difficult to grow owing to unfavourable soil conditions ; the results have so far been good, and if the young cedars continue to resist the climate and soil of the Alföld, the practical bearing of the trials will be considerable.

The arbor vitae (*Thuya occidentalis*) and *Biota orientalis* do well in the sunny parks of Szeged and Versec ; the latter can also be grown on slightly alcaline land, as at Kunszentmiklós.

The Austrian pine (*Pinus nigra* Arn.) (1) is the most important of the resinous species which have been tried in the Alföld, being suitable both in the Plain itself and in the hills bordering it. It does much better than Scots pine in the Plain soils ; on the sands of Déliblát there are small woods of tall and fine trunks, which are encouraging for the success of future plantations. It had been affrmed by Kirchner, Schröter and Loew (*Lebensgeschichte der mitteleuropäischen Blutenpflanzen*, p. 289, Stuttgart, 1906) that Austrian pine was less light-demanding than Scots pine, but it seems that in the Alföld the Austrian is highly light-demanding and will not stand shading. According to experiments at Gödöllö and Királyhalom, some other resinous species, such as *Pinus ponderosa*, *P. densiflora* and *P. Banksiana*, are suitable for planting and have given some success ; but data as to their yield of timber are not yet available.

(1) See *B.* June 1913, No. 690. (*Ed.*)

Silver birch (*Betula verrucosa* Ehrh.) grows wild in several places in the Alföld, especially on swampy land and on the sands of Nyirség, where the soil conditions are suitable for its germination. The downy birch (*B. pubescens*) is more a mountain species in Hungary.

Of the two alders, *Alnus rotundifolia* Mill. (= *A. glutinosa* Gaertn.) and *A. incana* D. C., the first is the more general, occurring throughout the Plain, especially by watercourses and on damp or swampy land.

Hornbeam (*Carpinus betulus*) is often dominant on hills, especially in the south-east of the country on the borders of the oak and beech areas; it also occurs in the oakwoods on clay soil in the Alföld.

Beech (*Fagus sylvatica*) was till lately supposed not to be native in the Alföld, but the foresters have found that it occurs here and there in cool places near watercourses.

Chestnut (*Castanea sativa* Mill.) does not occur wild in the Plain and does badly when planted. It is, however, numerous in the territory of Nagymaros and in the hill-country fringing the Western Alps of Hungary.

Oaks (*Quercus* spp.) are the most important native trees in the Hungarian Plain, where they have existed from prehistoric times. But much of the area formerly occupied has been cleared, either by excessive deforesting or for cultivation, so that they now occur only on the poorer soils. The writer believes there is not a single county in the Alföld without oakwoods or traces of their former presence. Fekete gives the following areas as occupied by oakwoods in the Hungarian Plain in 1888 :

County	Area — acres
Jásznagykunszolnok	453.0
Hajdú	38 397.9
Szabolcs	48 353
Békés	9.955.0
Bácsbodrog	31 287
Csanád	28.44
Torontál	12 799.3

In general six species of oak can be distinguished, apart from varieties and hybrids; these are : *Quercus robur* L. (= *Q. pedunculata* Ehrh.), *Q. sessiliflora* Sm., *Q. lanuginosa* Lam., *Q. conferta* Kit. (= *Q. hungarica* H.), *Q. cerris* L., *Q. tardiflora*. On the sandy soils of the Alföld *Q. robur* is the most widely distributed; on dry sand the oak forms open woods and is mixed with other species. On the steppes of Déliblát and in the districts of Kis-Kunság, Szabadka and Nyirség, it forms groups with white lime (*Tilia tomentosa*) and birch. Robinia often supersedes it after cultivation. Oaks do best in rich damp soil, where they form true forests and grow the finest trunks. The ancient oak forests of Bácska and Slavonia were formerly celebrated, but they too have been seriously reduced by felling. The pedunculate oak varies according to the ground in which it grows: in damp soil it grows tall and slender, and in dry soil remains small and thickset. The Hungarian oak (*Q. conferta*) requires a dry clay soil, and consequently

occurs in the southern part of the Alföld. It stands the full glare of the sun and also shade ; in mixed oakwoods it forms the most leafy lower storey. The value of its wood is not generally known ; it is esteemed by coopers because when once dry it never breaks ; they use it for barrels for transport.

Walnut (*Juglans regia* L.). — The walnut develops best in the sandy regions, and is there often grown for its nuts. It grows wild in Krassószörény county. *Juglans nigra* does well in the loess soils on the right bank of the Danube, and also in the south of the Alföld.

Willow (*Salix alba* L.). — Under the climate of the Alföld this is the most abundant species of *Salix* ; others occurring are : *S. caprea, S. cinerea, S. amygdalina, S. repens* and *S. fragilis.*

White poplar (*Populus alba* L.). — This tree occurs all over the Alföld, even on limestone. In the State nursery at Szeged it is grown from seed for planting sandy soil. *P. tremula* does not grow as tall as either *P. alba* or *P. nigra* in the Alföld ; the last-named may reach 80 ft. Of the native species, *P. nigra* resists moving sands best ; on the steppes of Déliblát these poplars may be found with the trunks standing 6 ft. deep in sand. Although poplars are native, authorities agree in attributing the groves in the Plain to planting.

Other species of the genus are : *P. deltoides* Marsh ; *P. pyramidalis* Roz., common in every village; *P. hungarica* Kit., fairly frequent, and according to Gombocz the female form of the Lombardy poplar.

Elm (*Ulmus glabra* Mill.). — The place occupied by poplar on sand is taken by elm on clay, and even to some extent on alcaline land. Thus it occurs in certain soils in the counties of Bihar, Békés and Csanád where no other trees grow. As the elm does well under the Alföld climate, resisting both the winter cold and the summer drought, and is not particular as to soil, being able to withstand even some alcali, the writer recommends it for the planting of the non-sandy soils of the Alföld.

Though *Tamarix gallica* does not grow wild in the Alföld and does not form a tree under the climate conditions prevailing there, the writer recommends planting it on alcaline land as a preparation for other trees.

Limes (*Tilia parvifolia* Ehrh., *T. grandifolia* Ehrh., *T. tomentosa* Moench). — *T. tomentosa* comes next to *Populus nigra* in abundance as a dominant in the sands of Déliblát ; it is valuable to the small farmers as supplying their bees with honey. For 11 years the Forest Administration has prohibited felling ; the oldest trees to be found now reach an age of 60 or 70 years ; they used to be cut over every 20 years.

Ailanthus glandulosa Desf. — This tree has been acclimatised in several counties of the Alföld, on heavy black clay soil ; the writer recommends it for soils too alcaline and dense for robinia. Although its timber has little value, it makes a fairly good firewood.

Robinia (*Robinia pseudacacia* L.). — This plays a very important part on the Alföld. Vadas estimates the area covered by it in 1910 at 78 240 acres.

Ash (*Fraxinus excelsior* L.) is frequent in the oakwoods, and here and there also dominates small areas.

Other trees and shrubs, wild or acclimatised, are : *Ginkgo biloba* L., *Corylus avellana* L., *Morus* sp., *Broussonetia papyrifera* Vent., *Celtis* sp., *Platanus* sp., *Ptelea trifoliata* L., *Rhus cotinus* L., *Acer tataricum* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. campestre* L., *A. negundo* L., *Staphylea pinnata* L., *Rhamnus catharticus* L., *R. tinctoria* W. Kit., *R. frangula* L., *Pirus communis* L. var. *piraster*, *Crataegus monogyna* Jacq.

57 – **The Forests of the Western Caucasus.** (1). — RÜBEL, E. A., in *The Journal of Ecology*, Vol. II, No. 1, pp. 39-42 + plates VII-IX. London, April 27, 1 14.

The Colchian mixed deciduous forests. — Colchis, on the eastern shores of the Black Sea, differs from the other regions surrounding the Caucasus in being very fertile and densely wooded. The rainfall is considerable and evenly distributed, so that the climate tends to be oceanic; with the Mediterranean climate the Colchian has only the warmth in common, neither the dry summer nor the mild winter, and the unfavourable season to which the vegetation must adapt itself is the winter. Consequently the dominant trees are not sclerophyllous, but summer-green. The Colchian district is characterised by deciduous forest with partly evergreen underwood ; this occurs equally on granite and limestone. The oriental hornbeam (*Carpinus orientalis* Mill.) is abundant and nearly dominant in large parts, especially at the lowest altitudes; the common hornbeam (*C. betulus*) is also present; maples are abundant and include *Acer pseudoplatanus* L., *A. campestre* L. and *A. laetum* C. A. Meyer; other abundant trees are wych elm (*Ulmus montana* With.), ash (*Fraxinus excelsior* L.), and especially *Tilia caucasica* Ruppr., as well as oaks (*Quercus robur* L. and *Q. sessiliflora* Salis.). The prominent trees are thus mostly the same as in the oceanic parts of Europe, but in very luxuriant forms with large leaves. Epiphytes and lianes are very abundant, and the underwood is usually rich, sumachs (*Cotinus coggygria* Scop. and *Rhus coriaria* L.) being prominent ; the ground vegetation consists of luxuriant herbs and grasses. From about 300 m. the montane evergreens become more prominent : *Prunus laurocerasus* L., *Ilex aquifolium* L., *Buxus sempervirens* L. (reaching 8 m. in height and 20 cm. in diam.), *Rhododendron ponticum* L., *R. flavum* L.

Beech forests. — The beech forest is widely distributed in the Caucasus; its main belt lies between 700 and 1500 m., but it may ascend to the tree limit and descend into the hornbeam mixed deciduous forest. The beech here is *Fagus silvatica* L. var. *asiatica* D C. (= *F. orientalis* Lipsky). The differences in composition on granite and limestone are slight, but two well-defined associations can be distinguished by altitude : from 700 to 1000 m. occurs a dense shady beech forest nearly devoid of undergrowth, many trunks being 1 m. in diameter, in which occur isolated examples of *Ulmus montana*, *Tilia caucasica* and *Carpinus orientalis* and *C. betulus* ; from 900 to 1500 m. beech dominates as standards with a dense under-

(1) The importance recently assumed by the forest reserves of the Western Caucasus for the Mediterranean timber trade should be noted. (*Ed.*)

wood of *Prunus laurocerasus*; this *Fagetum asiaticae laurocerasosum* is intimately related to the *Fagetum silvaticae aquifoliosum* of the subalpine belt in Corsica.

Needle-leaved forests (*Aciculisilvae*). — The subalpine belt is characterised by needle-leaved forests formed by *Abies Nordmanniana* Stev., *Picea orientalis* Carr. and *Pinus silvestris* L. The pine forest is extremely similar to those of the Alps, occupying the same type of habitat on the northern side of the Caucasus. *Picea orientalis* often occurs in beech and fir forests, but may become dominant on deep loamy soils in ravines. The most conspicuous conifer forests are those of *Abies Nordmanniana*, which cover large stretches on both slopes of the Caucasus; on the northern dry side they leave the driest and most exposed slopes to the pine; on the southern side firs mix with the ascending beeches, but moist localities on both sides bear a beautiful, dense and pure fir forest, within which occur many European species as well as *Rhododendron caucasicum* Pall. and *Vaccinium arctostaphyllos* L.

To sum up, the forests of the Western Caucasus show very considerable resemblance to those of Central Europe and extremely little to those of the Mediterranean. As in Central Europe, the subalpine zone is mostly clad with needle-leaved forests, whilst those of the lower belt belong to the formation group of *Aestatisilvae* (summer forests). Very rich mixed deciduous forests cover the lowlands, beech forest with laurel-leaved underwood dominating the higher belt, while *Abies Nordmanniana* woods clothe the highest tree-bearing zone, leaving the dry poor slopes to *Pinus silvestris* forests. These communities are all climatic, each being the climax for its own climate.

58 – **Natural and Artificial Regeneration in the Forests of Northern Sweden.** — Wibeck, E. (Report from the State Institute for Forestry Experiments), in *Meddelanden från Statens Skogsförsöksanstalt*, Part 10, pp. 91-138 + fig. 13 Stockholm, 1914.

This report deals with two series of experiments in the forests of Northern Sweden and contains a general discussion on the subject.

The experiments of the first series, on the power of natural regeneration of Scots pine after clear felling, have almost always given satisfactory results; the writer concludes that in Northern Sweden clear felling is the most satisfactory method for Scots pine, as its seedlings are so light-demanding that even a slight shading prevents the new stand from getting a hold.

In the second series the object was to ascertain how to get the best stand in spruce forests on swampy land; Scots pine has been found the best tree for this purpose.

Experiments have also been made on sylvicultural methods, and especially on the value of seed from different regions. Scots pine seed collected in Northern Sweden itself has been found to give much the best results, and it is probable that want of success in former experiments was due chiefly to the use of seed from the south of the country.

A bibliography of 75 works is appended.

59 – **An Experiment in Manuring Forest Nurseries.** — RUŠNOV, P. v., in *Mitteilungen aus dem forstlichen Versuchswesen Österreichs*, Part XXXVIII, pp. 56-64. Vienna, 1914.

Partial results of experiments with manures for forest nurseries show that steamed bone-flour and basic slag have no marked influence on the growth of spruce and Scots pine seedlings.

60 – **Experiments in Thinning Beech and Scots Pine Woods.** (Nach den Aufnahmen der forstlichen Versuchsanstalt für das Grossherzogtum Hesse). — WIMMENAUER, in *Allgemeine Forst und Jagd Zeitung*, Year XC, pp. 84-90. Frankfort-on-the-Main, 1914.

The writer, with the help of data collected by the Experimental Forest Institute of the Grand-duchy of Hesse, reports, with exhaustive particulars and tables, on the results obtained by experimental thinnings continued for the last 25 years in the dominated trees on plots 0.62 to 2.47 acres in extent, distributed in groups of 3 to 5 in 17 experimental areas under beech and Scots pine.

The research work has dealt not only with the production in volume, but also with that in value. With this object, and in order to overcome the difficulty of distributing the various sorts of wood, a new method of calculation based on the value-metre (Wertmeter) has been introduced. Thus for beeches 79 years old, that is not yet quite mature for timber, the value-metre was determined by considering the faggot wood as being worth one half the value of timber, so that if for instance there were 60 cubic metres (1) of the latter and 40 of the former they would be considered as 80 value-metres.

For Scots pine the calculation is quite different, because the ratio between the assortments of a stand depends chiefly upon the average diameter of the same; the assortments corresponding to the various average diameters were determined and their market value ascertained, assuming that a value-metre was that quantity of wood worth 10 Marks (9*s* 10*d*); thus an average diameter of 16 inches corresponds to 40 per cent of sawn timber worth 22*s* 2*d* per cubic metre, 40 per cent of building timber worth 16*s* 9*d* per cu. metre, 10 per cent of fire-wood above 2.8 inch in diameter worth 5*s*. 2¼*d* per cu. metre, and 10 per cent of faggot wood worth 7*d*. per cu. metre. This would give an average of 16*s* 2*d* per cubic metre and therefore a tree of such a diameter would correspond to 1.65 value-metres.

The results obtained proved somewhat inferior to the expectation. The beech areas showed that both the total volumes and the percentage increments with light, average and severe thinning in the lower storey varied irregularly and did not differ much from each other, and even with thinning in the upper storey and on the selection system, saving in a few cases, the results were not much better.

(1) 1 cubic metre = 35.315 cubic feet. (*Ed.*)

BEECH. — *General Averages.*

Production	Thinning in lower storey			Thinning in upper storey	Thinning on selection system
	light	medium	severe		
Value-metres	100	98	102	106	92
Increment per cent.	4.0	4.1	4.5	4.5	4.9

Thinning in the lower storey on pines did not yield any noticeable result.

SCOTS PINE. — *General Averages.*

Production	Thinning in lower storey		
	light	medium	severe
Value-metres	95	100	96
Increment per cent	4.0	4.1	4.0

Independently of these experiments the writer obtained noteworthy results by comparing different methods of estimation. Starting from the idea that thinning has two effects : an increased increment in the remaining classes of trees, which is expressed by the difference between the increment per cent of the thinned stand (z) and that of the unthinned stand (y) ; and secondly an anticipated return in cash and therefore a corresponding interest (p) instead of the percentage increment of the thinned classes (x). Consequently, the original stand being H, the thinned stand D, the financial expression of the thinning will be :

$$\Delta = H\ (z-y) + D\ (p-x).$$

In practice, starting from the usual five classes of trees, the product of each should be determined and thus the total would be obtained.

The three beech test areas were thinned every five years and five times, their original ages being respectively 67, 67 and 63 years. In the first, thinning in the lower storey was practised in classes I-III; in the second, selection thinning in classes III-V; in the third, thinning in the upper storey in classes II-V; a fourth area was thinned lightly and was used as a check in order to determine the increments, x and y of the formula, while the increment z of the thinned stand was calculated for every class of trees and for a period of 20 years.

Increments	Class I	Class II	Class III	Class IV	Class V
x or y	0.3	2.2	3.3	3.6	3.8
z in 1 st area	1.2	3.1	3.6	4.3	3.9
z In 2nd area	2.4	3.6	3.8	3.5	3.1
z in 3rd area	1.5	3.6	4.6	3.9	4.1

The various methods of thinning yield characteristic results. From a medium thinning in the lower storey, the more developed classes of plants derive most benefit, while with selection thinning much irregularity is observable. In thinning in the upper storey the greatest increment takes place in the intermediate class III; nevertheless the total percentage increments do not vary much (3 ; 3.7 ; 3.4 ; 3.6). Applying the formula to the preceding data and making $p = 3$, the final result for the three different manners of thinning would be 152.1, 75.2, 147.8 value-metres, that is to say that selection thinning is financially only one half as effective as thinning in the upper on lower storey, which give nearly the same results.

As for the second object of thinning, the interest on the money instead of the increment of wood, the best results are obtained by thinning in the lower storey, less with that in the upper storey, and least of all with selection thinning. The increment increase for the principal stand is 86.1, 113.1 and 129.2 value-metres respectively for thinning in the lower storey, thinning in the upper storey and selection thinning.

The writer concludes by expressing his opinion that in estimating thinnings, only exact calculations can give reliable results.

61 – **Experiments in Thinning Douglas Fir *(Pseudotsuga douglasii* Carr.) in Austria.** — KUBELKA, A., in *Mitteilungen aus dem forstlichen Versuchswesen Österreichs*, Part XXXVIII, pp. 9-34 + 10 figs. Vienna, 1914.

The writer reports experiments in thinning carried out since 1905 in a wood of Douglas fir situated in the district of Aurach (Gmunden). Three plots were taken, one of which was subjected to light thinning in the upper storey, one to medium thinning in the lower storey and the third to severe thinning in the lower storey. Every year they were estimated. The absolute growth in section and volume was nearly the same during the five years, while the relative growth was naturally greatest on the plot severely thinned.

In 1910 the average increment per class according to age, that is when the plantation was 23 years old, was very remarkable : 137 cubic feet per acre for the first plot, 171 cu. ft. for the second and 150 cu. ft. for the third.

The writer concludes from the results obtained that Douglas fir, taking into account also the technical properties of its timber, is to be considered as a forest tree very suitable for good spruce soils ; and that, starting from rather dense plantations, from 1800 to 2000 trees per acre, thinning should be practised, and especially thinning in the upper storey, leaving the underwood.

62 – **The Utilisation of Resin in Austria.** — KUBELKA, A., in *Mitteilungen aus dem forstlichen Versuchswesen Österreichs*, Part XXXVIII, pp. 35-55 + figs. 11-12 Vienna, 1914.

After having reviewed the unsatisfactory results obtained with the usual methods employed for the extraction of resin from Austrian pine in Lower Austria, the writer proposes a new method consisting in attaching to the tree, instead of the glass vessel at present employed, a cast iron retort which is fastened by means of a screw passing through the length

	Old system of extraction and old system of distillation			Old system of extraction and new system of distillation			New system of extraction and new system of distillation		
	£ s d	£ s d		£ s d	£ s d		£ s d	£ s d	
Sale price of finished products:									
430 lbs. of colophony at 10*s* 2*d* per cwt.	1 19 0								
110 lbs. of essence of turpentine at 32*s* 2*d* per cwt.	1 11 8								
540 lbs.		3 10 8							
430 bs. of colophony, at 11*s* 1 ¼*d* per cwt.				2 5 6					
120 lbs. of essence o turpentine at 33*s* 10½*d* per cwt.				1 16 4					
550 lbs.					4 1 10				
463 lbs. of colophony at 11*s* 10¼*d* per cwt.							2 9 0		
270 lbs. of ess nc of turpentine at 33*s* 10½*d* per cwt.							4 1 8		
733 lbs								6 10 8	
Cost of collecting:									
Collecting	1 10 0			1 10 0			1 10 0		
Cartage 2½*d* per cwt.	1 3			1 3			1 3		
Freight				1 0½			1 0½		
Cost of distilling:									
1*s* 0¼*d* per cwt.	6 3			6 3			6 3		
Sundrie 2 ½*d* per cwt.	1 3	1 18 9		1 3	1 19 9½		1 3	1 19 9½	
Net returns		1 11 11			2 2 0½			4 10 10½	

of the neck of the retort. By this means the considerable advantages would be obtained of having a purer product and of complete collection of the turpentine, the greater part of which was lost by the old system (1). Also in the method of working up the crude resin the writer proposes an essential reform by introducing a suitable distilling plant on the French model. He then calculates the yields as set forth in the accompanying table and based on current prices and on a production of 660 lbs. of resin

(1) This method is similar to that already employed in North America. (*Ed.*)

by the old method, and 770 lbs. by the new method, from 100 Austrian pines.

The writer expects from this reform in the utilisation of resin a greatly increased yield from the Austrian forests of black pine and also a considerable economic adavntage, as the resinous products which are imported for a value of £833 333 might be produced in the country itself.

The new method of resin extraction should also be taken into consideration for Scots pine and for larch.

63 – **The Condition of Forestry in Portugal.** — REDONDO, A., in *Broteria*, Vol. XII, Part VI, pp. 375-376. Braga, November 1914.

Of recent years forestry has developed slowly but continuously in Portugal. Pine plantations have increased considerably, since their products find a ready sale in the markets. The forests cover a total of 19 per cent of the area of the country and consist chiefly of the following:

	acres
Maritime pine (predominant) and stone pine	1 910 547
Holm-oak	899 249
Cork oak	817 459
Chestnut	200 558
Various species of deciduous oak	169 229

Pines predominate in the northern part of the country in the mountainous region of abundant rainfall. In the southern part, which is flatter and drier, holm-oaks and cork oaks predominate. Acorns for feeding pigs constitute one of the principal sources of wealth in the region south of the Tagus. Cork is stripped from the trees in the plains every 9 or 10 years and in the mountainous districts every 11 or 12 years, and constitutes the most important forest product exported. Chestnuts, which are a source of wood as well as food for man and live stock, tend to disappear owing to the ravages of the ink disease.

The following table, showing the value of forest products, indicates the development of forestry in Portugal during a period of 40 years.

	1870	1910
	£	£
Timber	32 358	206 690
Cork	143 906	992 191
Various forest products	12 291	34 001
Total	£ 188 555	£ 1 232 881

LIVE STOCK AND BREEDING.

64 – **Borax in Stables to Prevent the Breeding of Flies.** — RHODES, C. D., in *Journal of the U. S. Cavalry Association*, Vol. XXV, No. 104, pp. 339-340. Fort Leavenworth, Kansas, October 1914. HYGIENE

Recent experiments by the U. S. Agricultural Department at Arlington, Va., and at New Orleans, La., show that a small amount of ordinary borax sprinkled daily on manure will effectually prevent the breeding of typhoid or house fly. Borax will not kill the adult fly, but will sterilize the fly eggs whether found in manure, garbage of any kind or crevices in floors.

The above experiments proved that 0.62 of a pound of borax or 0.75 of a pound of calcined colemanite (crude calcium borate) would kill fly-maggots in eight bushels of horse manure. In garbage cans and refuse piles two ounces of either of the above substances prevented flies from breeding.

The method of using the borax or colemanite is as follows : It should be sprinkled, in the quantities given above, around the outer edges of the pile of manure through a fine meshed sieve. Immediately after, the manure should be sprinkled with water in the proportion of two or three gallons to eight bushels of manure. It is very desirable that a little borax be sprinkled daily instead of waiting until a large pile has accumulated, as the insecticide acts more promptly on the new laid eggs. As fly maggot congregate at the outer edges of manure piles, most of the borax should be sprinkled there.

At the cost of five or six cents a pound, it is estimated that the cost of this treatment in city stables should not exceed one cent per horse per day. Hitherto the use of iron sulphate and potassium cyanide has been too expensive to allow of extensive use.

The moderate use of borax on manure has been found to have no injurious action on the subsequent use of the manure for agricultural purposes ; the result of a more extensive use of borax in this connection has not yet been determined, but is being studied.

65 – **On the Possible Occurrence of Tuberculosis Bacilli in the Blood of Cows, especially after the Injection of Tuberculin.** — BRANTE, LARS, in *Zeitschrift für Infektionskrankheiten, parasitäre Krankheiten und Hygiene der Haustiere*, Vol. 16, Part 3, pp. 187-194. Berlin, November 10, 1914.

The object of this experiment was to ascertain whether, in the case of tuberculous cows, subcutaneous tuberculin injections could cause the tuberculosis bacilli present in the animal's body to free themselves and appear in the blood.

For this purpose 50 cows in all, from 3 to 14 years old, were examined, all of which gave distinct tuberculin reaction. Five had distinct tuberculosis of the lungs, while three suffered from advanced general tuberculosis and tuberculosis of the udder, as was proved by *post mortem* examination.

Samples of blood being taken from each cow, an intramuscular injection of 5 cc. of residuum (after centrifugation) was given to two guinea-pigs.

Then 0.5 gm. of tuberculin was injected into each cow (0.75 gm. being used in the case of three animals). After the lapse of from 16 to 18 hours, fresh samples of blood were taken from the subjects of the experiment and a number of guinea-pigs received injection of 5 cc. of the residuum of the blood from the cows (2 guinea-pigs being used for each cow).

Of the 200 guinea-pigs thus treated, 9 died before the conclusion of the experiment; in no case, however, was the injection made from the same sample. The rest of the guinea-pigs were killed in from 7 to 17 weeks after treatment and subjected to a *post mortem* examination. None of them had tuberculosis. Thus we find that in the blood of the 50 tuberculous cows no tuberculosis bacilli were to be found, either before or after the tuberculin test.

It can therefore be concluded that no freeing of bacilli takes place through reaction to tuberculin injection.

66 – **Scrapie in Sheep.** — *Board of Agriculture for Scotland, Leaflet* No. 15, pp. 1-6. Edinburgh 1914.

During the last two years enquiries into the history and characters of the disease known as "scrapie", which has caused heavy losses in the South-East of Scotland and the North of England have been made by Dr. J. P. M' Gowan.

A disease indentical in symptoms with scrapie existed in England, France and Germany almost two centuries ago. References to the malady were more common during the middle and the latter half of the eighteenth century than in the nineteenth.

Previous to the outbreak which has been the occasion of Dr. M' Gowan's enquiry, there is no mention of the disease ever having existed in Scotland.

The first symptom shown by an affected sheep is usually a slight twitching of the tail or flicking of the ears. It then begins to show more marked evidences of itchiness, especially of the head, tail and hind quarters. No scab or roughness, however, is to be seen on the skin. Its wool in parts either falls out or is rubbed off. It is mostly restless, nervous, shy and apparently suffers most on hot sunny days. It has sometimes a great thirst. Its appetite remains good, but it falls away in condition. Diarrhoea is not present. Its gait becomes a trot, and it no longer gallops. If its foot catches against anything, it falls in a heap and rises again with difficulty, while it experiences more and more difficulty in getting about. Extreme emaciation follows, and death supervenes.

Of recent years scrapie seems to be most prevalent among Half-bred stocks, but Cheviots have suffered severely and Border Leicesters have not altogether escaped. In preceding epidemics, many other breeds suffered: the Down and other breeds in England and the Merinos, especially the more finely bred varieties, on the Continent. The outbreak of recent years has been confined to the counties of Roxburgh, Berwick, and Northumberland.

Scrapie shows itself for the most part when the sheep is about two years old. From the numerous *post mortem* examinations made by Dr. M' Gowan, the feature common to all cases was extensive infection with a microscopic parasite, *Sarcocystis tenella*. It appears that these parasites occur in the musceles of a large proportion of mature sheep; when their numbers are small the sheep suffer no bad effects, but when they are numerous, scrapie appears.

The sarcocyst multiplies and spreads throughout the body of the sheep. It generates a poison, which, circulating in the blood, affects the nerves of the skin and gives rise to the characteristic itching. The presence of these parasites in large numbers in the muscles accounts for the restricted use the affected sheep are able to make of their limbs.

By injecting into rabbits an emulsion prepared from the muscles of sheep which had scrapie, the typical itching was produced, while rabbits inoculated with a similarly prepared emulsion from the muscles of healthy sheep were in no way affected.

Dr. M' Gowan believes that scrapie is not contagious. Some farmers have gradually got rid of the trouble by bringing to their farms young healthy sheep which, although allowed to mix freely with the affected stock, never contracted the disease. As the older ages were gradually disposed of, scrapie disappeared from the flock. Dr. M' Gowan further does not consider that the rams have any responsibility for introducing or spreading the disease among a flock, for when scrapie has broken out it usually begins with only a single case or two, while if it had been introduced by a ram many of his progeny would have developed it. In addition there are undoubted instances of a ram suffering from scrapie serving ewes without either the ewes or their lambs being affected.

Dr. M' Gowan's conclusion is that lambs receive the infection before birth. As a rule, lambs from affected ewes sooner or later develop the disease, although affected ewes have produced healthy lambs and healthy ewes have produced lambs which in time have shown that they were affected. In one experiment, four lambs from ewes badly infected with scrapie were removed from their mothers the moment they were born. They were kept on land on which no sheep had been grazed for many years and thy were reared entirely on cow's milk. In due time all the lambs developed the sarcocyst in large numbers, thus showing that they got the infection when in the foetal stage.

As the age of maximum occurrence of the disease is about two years, it is dangerous to maintain a breeding stock by keeping the ewe lambs from the two-year-old ewes.

According to Dr. M' Gowan no curative treatment is known, but the disease can be controlled by adopting the following methods :

1. Affected animals should be sent to the butcher at once before they become emaciated.

2. The older sheep should be gradually eliminated and fresh young ewes from clean flocks brought in.

3. Where a complete change of sheep is not made, the breeding stock should be kept up from the progeny of the older ewes, and the progeny of the two-year-old ewes, and possibly of the two-crop ewes should be sent to the butcher.

4. Under no circumstances should a diseased animal be used for breeding.

5. Inbreeding should be avoided or at all events conducted with the very greatest caution.

67 – **The Use of Calomel in the Control of Swine Plague.** — FICAI, G., and CECCHERELLI, R., in *L'Agricoltura Toscana*, Year 5, No. 16, pp. 431-435. Florence, August 31, 1914.

The writers have used calomel, among other remedies, with much success in the control of swine plague in the Italian province of Arezzo, a district where the disease has wrought great havoc for many years. In over 100 cases treated with calomel, not a single death occurred, while in infected control styes, in some cases as many as 90 per cent of the animals succumbed.

The remedy appears to be most efficacious where it is administered before the disease is far advanced, and is best given on the first appearance of the symptoms. Its effect is doubtful in advanced stages of the plague.

The doses which can safely be given per head are as follows :

1	gm.	per	dose	for sucking and young pigs.
2-2½	"	"	"	half-grown pigs.
4	"	"	"	adult pigs.

In the case of pregnant sows, the dose is best administered in 3 portions within 36 hours. The calomel should be given in a boiled potato or in a meal or honey mash which is fed to the pigs. If after two or three days, no marked improvement in their condition takes place, the same dose should be repeated or even given a third time. In no case did the writers observe any bad effects upon the organism by so doing.

Calomel was also given to healthy pigs in an infected stye, and it was observed that these animals did not fall ill, which proves that calomel is a prophylactic as well as a remedy.

In what manner calomel affects the animal organism, the writer has, so far, not been able to ascertain.

ANATOMY AND PHYSIOLOGY

68 – **The Relations of Vitamine to Lipoids.** — COOPER, EVELYN ASHLEY, in *The Biochemical Journal*, Vol. VIII, No. 4, pp. 347-354. Cambridge, August 1914.

Vitamine, the substance which prevents beri-beri and avian polyneuritis, is present in higher concentration in various tissues rich in lipoid, *e. g.* liver, cardiac muscle, brain and egg-yolk, than in voluntary muscle (ox, fish) which is poor in lipoid. It contains no phosphorus or carbohydrate. Lecithin and lipoids may show a slight curative action, but when purified by means of ether, they lose their curative power. Thus, it appears that the anti-neuritic substance is not a lipoid, but exists in combination with lipoids in the animal tissues.

The greater part of this substance is extracted from tissues by means of 95 % alcohol, from which it is precipitated by ether. In the case of brain extract, however, it is only partially precipitated by ether. This suggests the existence in brain of an ether- and acetone-soluble substance which possesses a marked affinity, chemical or adsorptive, for vitamine, and which may function as a carrier in the living organism.

It also appears that the injurious effect of lipoid-free diets observed by STEPP is due not to the deficiency of lipoids, but to the mechanical removal of vitamine during the alcohol-ether extractions. Lipoids may therefore be considered as carriers of the vitamine until required by the organism.

69 – **Experiments with Abderhalden's Method for the Early Determination of Pregnancy.** — CAMPUS, ANTONIO, in *La Clinica Veterinaria, Rassegna di Polizia Sanitaria e di Igiene*, Year 37, No. 20, pp. 847-867. Milan, October 30, 1914.

After a detailed discussion of the Abderhalden dialysis method (1), the writer gives some data respecting his own practical experience of this method. For the preparation of proteolytic ferments he used as substratum for each experiment about 1 gm. of the placenta of a woman, a cow, a ewe and a sow. The 72 animals employed for the experiment were cows, mares, ewes, sows, goats and rabbits. Some of these were pregnant; others were in normal, or pathological, conditions. The amount of serum used for each experiment was 1.5 cc.

For technical reasons, the serum was not always obtained from spontaneously coagulated blood, but in part also through the coagulation of the plasma after previous centrifugation of the blood. In all cases, however, it was clear, sterile and free from haemoglobin. Of the 24 normal animals which were subjects of the experiment none showed any trace of proteolytic ferment in the dialysate. The same may be said in the case of animals suffering from typhoid, strangles (horses), liver-fluke (sheep), etc. A positive reaction could be observed in all the 42 pregnant animals (34 cows, 6 ewes, 2 goats). In two cases the reaction was not very marked, but in comparison with that of other serums it must also be pronounced positive. The proteolytic ferment was produced shortly after fertilization, for in the case of three cows its presence could be ascertained a fortnight after bulling. The sharpness of the reaction is, as the writer was able to satisfy himself, independent of the stage of pregnancy, for one cow always gave the same reaction after 25 days', 5 months' and 9 months' pregnancy.

The proteolytic ferment does not lose its property of splitting protein if the sterile serum is kept for some time at a low temperature; the writer found a serum still effective one month after the blood had been taken. The effectiveness of the serum ferment is not limited to any special placenta proteid.

The writer draws the following conclusions from his experiments:

1. The Abderhalden reaction gives positive results in 100 per cent

(1) See full description in *B.* Nov. 1913, No. 1267. (*Ed.*)

of cases if the animals are pregnant, while the results are negative with diseased or normal non-pregnant subjects.

2. It can have a positive result 14 days after fertilisation, and is independent of the stage of pregnancy.

3. The effects of the proteolytic ferments are not confined to any special kind of placenta.

4. This method should have a great future before it in the hands of the stock-breeder, and, after some improvements have been introduced into the manner of carrying it out, it should be adopted by practical farmers.

70 – **The Importance of the Glycerides of the Fatty Acids of Low Molecular Weight Present in the Milk-Fat of Different Mammals.** — GUTZEIT, E., in *Kühn-Archiv*, Vol V, pp. 127-138. Berlin, 1914.

The quantitative composition of the milk of different species of mammals shows a conformity to law which it has been possible to connect with the phylogeny, physiology and ecology of the species in question. The milk of the smaller animals, for example, which develop faster than the larger ones, usually contains more dry matter, which is explained by the fact that the more rapid growth of the young animal necessitates a larger supply of nutritive substances, which on account of the limited capacity of the stomach must be administered in a more concentrated form. The nearer the relationship of the animals, the more similar will the composition of their milk be. The composition of the fat has been the subject least studied in the comparative analysis of the milk of differerent mammals. It is known that in the butter-fat of cow's milk, in addition to the three or four neutral fats (palmitin, stearin, olein and myristin), which also enter into the composition of animal and plant fats, there are present considerable quantities of several glycerides of the volatile fatty acids (capric, caproic and butyric acids). The fact that the existence of these glycerides of fatty acids of low molecular weight facilitated the detection of adulteration of the butter-fat of cows' milk led to a more careful investigation of these volatile fatty acids.

The content of these substances in fat is expressed by the Reichert-Meissl value. The variation limits of these figures have been established by numerous analyses, as have also the circumstances which affect them. It has been ascertained that they are highest soon after calving, and decrease as the lactation period advances. To the average of about 28 of the Reichert-Meissl value corresponds, in the butter-fat of cow's milk, about 8 or 9 per cent of the glycerides of the volatile fatty acids soluble in water.

KIRCHNER expresses the opinion that the flavour and value of butter as an article of food depend on the presence of these glycerides, which impart to it a special aroma. That, however, it is not the aromatic flavour only which determines the value of butter, is shown by the fact that in the process of manufacturing melted butter (*Butterschmalz*), for which not only the spoiled product, but also (according to FLEISCHMANN) fresh butter is used, the development of the aroma is hindered. Further, in well-made

butter, the fat is finely divided, as it is in milk, to which circumstance FLEISCHMANN attributes the fact that butter-fat is very easily digested by the gastric juices and agrees with people better than any other fat. As not only the neutral fats, which constitute the other fats, but also the fatty acids derived from them, are insoluble in water, and are therefore assimilated with more difficulty by the digestive juices, than the volatile fatty acids which are soluble in water, and as these 8 or 9 per cent of glycerides are present in butter-fat in the form of mixed glycerides and not as simple tri-glyceride, the great digestibility of butter-fat as compared with other fats is easily understood.

The question now arises as to how the milk fat of other animals stands in this respect. First, human milk was examined, of which the fat content is about 4 per cent higher than that of cow's milk. As the experiments of VON LAVES, PIZZI, ARNOLD and the writer have proved, there are in human milk very small quantities of all the volatile fatty acids (Reichert-Meissl value = 2.). In this respect, therefore, there is a great difference between the fat of human milk and that of cow's milk.

According to the experiments of VON LAVES, PIZZI and GUTZEIT, the amount of the glycerides of fatty acids of low molecular weight present in the milk fat of various animals is as follows:

Kind of milk	Volatile fatty acids (Mesaured by the R. M. value)
Sheep	30.0
Cow	28.0
Goat	24.0
Rabbit	16.0
Ass	13.1
Mare	11.2
Cat	4.4
Mouse	2.9
Human	2.0
Whale	1.6
Sow	1.6
Bitch	1.2

Contrary to GRIMMER, who wishes to introduce a distinction between albumen and casein milks, the fat of the latter being rich and that of the former poor in these acids, the writer gives in the following table three groups which are very distinct from one another:

1. Ruminating animals	R. M. value	30-24
2. Non-ruminating herbivora	R. M. value	16-11
3. Carnivorous and omnivorous animals	R. M. value	4-1

These observations oblige one to accept as a fact the connection between the food of the adult animal and the composition of the fat administered to the young in its mother's milk, according to which the Reichert-Meissl

values are higher for herbivoous animals and lower for carnivorous and omnivorous animals.

If the small quantity of the glycerides of fatty acids of low molecular weight present in human milk is to be explained by the omnivorous nature of adult man, the question arises as to why cow's milk should be less easily digested by the human infant than woman's milk, seeing that it has been demonstrated that fats containing a larger amount of such glycerides are easily digestible.

The heating of the milk given to the infant has been regarded by some as the cause of the deterioration of its nutritive value, for by the action of heat the albuminous bodies present in the milk are altered and become more difficult of digestion, while the lecithin content is destroyed, and the soluble lime salts are transformed into insoluble tricalcium compounds, causing an insufficient lime assimilation and promoting rickets.

From their experiments on healthy children and those suffering from rickets, CRONHEIM and MÜLLER have however proved that the tricalcium phosphate produced by boiling milk is utilised as well as the soluble lime salts found in raw milk. Further, if one considers that the average lime content of cow's milk is 0.16 per cent, and therefore considerably higher than that of human milk (0.03 per cent), while the total solids of the two are about equal (cow's milk 12 per cent, human milk 11 per cent), it is clear that rickets in children reared on cow's milk is due to a relative, and not an absolute, want of soluble calcium salts.

Of late years experiments have been made on children fed partly on skimmed milk and partly on whole milk, and although in both cases the amount of lime given was the same, it was observed that where the children were fed on skimmed milk, the organism became richer in lime, while it became poorer in the case of those who received whole milk. On examining the excrement of the children with a sufficient and insufficient assimilation of lime, there was found, in the first, some unresorbed fat in the form of undecomposed neutral fat, and in the second, so-called saponified feces, *i. e.* fat which contains fatty acids of which some are free and others combined with lime. As such saponified feces are especially present when cow's milk is used, it must be caused by a different composition of the butter-fat, *viz.* by the larger amount of the glycerides of the volatile fatty acids soluble in water, inasmuch as these are easily split up and form readily soluble lime compounds which leave the infant's body without being assimilated.

Unless the butter-fat can be as much as possible removed, all attempts to find in cow's milk a complete substitute for human milk as a food for infants must thus be fruitless.

Further, these experiments give the required solution of the question why there is so small an amount of the glycerides of fatty acids of low molecular weight in the fat of human milk, namely that the possible loss of lime through the formation of saponified feces is excluded, the amount of lime present in human milk being just sufficient for the infant's needs.

This conclusion becomes the more probable the more generally this theory is applied. As we mentioned above, the Herbivora are distinguished by having in their milk a larger quantity of the glycerides of volatile fatty acids soluble in water. Their purely vegetable diet is richer in lime than any other, so that these animals can yield milk rich in lime as well as a fat rich in these glycerides, and therefore easily digested, without causing in their offspring any loss of lime. This is specially the case with ruminating Herbivora, which utilise their food most; in them the highest figures of the Reichert-Meissl values are found. Thus the buffalo cow, which lives on hard plants, according to the analyses of FARTLER and PETKOW, yields a milk with an extraordinarily high lime content, and of which the fat shows a yet higher Reichert-Meissl value than that of cow's milk. In the case of non-ruminant Herbivora, which cannot utilise their food to so great an extent, any possible loss of lime is excluded, either by decrease of the Reichert-Meissl value, or (in mares and asses) by the diminution of the milk fat content.

Finally, the milk of carnivorous and omnivorous animals, whose diet contains less lime, has the lowest Reichert-Meissl values, whereby alone a deficit in the lime balance of the young organism is avoided.

71 – **Increase in the Milk Secretion of Cows under the Influence of Subcutaneous Injections of Carbohydrates.** — RICCI, RENATO, and D'AMATO, ANTONIO, in *L'Agricultura Italiana*, Year X, Part 20, pp. 609-616. Pisa, October 31, 1914.

A continuation of the studies of Professor LOMONACO, director of the Institute of Physiological Chemistry at the Royal University of Rome, and of his pupils, relating to the influence of sugar on lactic secretion. These experiments, carried out at the Pisa Agricultural College, were suggested by the results obtained by Professor Vittorio Nazari, who increased the milk-yield of cows by means of subcutaneous injections of carbohydrates.

The experiments were carried out with a Dutch cow which weighed 836 lbs. before the experiment and 847 after.

The injections consisted of lactosecretine, a very strong solution of saccharose, glucose and galactose. They were repeated regularly at 5-30 p. m. at the rate of one per day during three weeks beginning May 18, 1914. The quantity injected was 5 cc. per day. Before the experiment began, the cow was fed on a constant diet for one week before the first injections, and a daily milk record was kept. The rations remained constant until June 7, when the observations terminated. The quantity of milk obtained before the injections were administered from the 11th to the 17th of May averaged 14.76 lbs. per day; during the first week of the experiment it averaged 17.00 lbs., during the second week 17.85 lbs. and during the third week 16.86 lbs. The greatest increase in the milk yield was obtained between the 22nd and 31st of May, whilst during the last week of the experiment the daily average was 17.20 lbs. during the first three days and 16.53 lbs. during the last four days.

Samples of milk were taken before and during the experiment and their composition and yield in cheese were studied. The results showed a fairly

constant composition, though the samples taken during May 17-19-21, in the first week of the experiment, showed an increase in the fat content, and those taken during May 19-24-27 showed an increased yield of cheese and " ricotta ".

These results are interesting in showing that the dose required to increase the lactic secretion of the cow is about 5 cc. and that the increased yield is also associated with a better quality of the milk. Also, they show the necessity for further experiments over a longer period, in order to determine if the effects are continuous or only temporary and if this substance, which the writer proposes to call *zoolactosecretine*, is of different efficiency with cows of different milk-yielding capacity.

72 – **Amino-acids and the Proteins of Maize in Nutrition and Growth.** — OSBORNE, T. B., and MENDEL, L. B. (Connecticut Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XVII, No. 3, pp. 325-349; Vol. XVIII, No. 1 pp. 1-16. Baltimore, Md., April and June 1914.

1. — Growing rats were fed on diets in which protein was supplied only under the form of gliadin, which contains 1 per cent of tryptophane but only insignificant amounts of lysine and which has been shown repeatedly to be inadequate to produce growth in animals. The rats failed to grow on diets containing gliadin as the sole protein, but when lysine equivalent to 3 per cent of the protein was added to the food, growth was immediately resumed; lysine was subsequently suppressed for a period, and growth immediately ceased during that period, to be resumed as soon as the diet included lysine again.

In another set of experiments, zein was used as a source of protein. This protein contains neither lysine nor tryptophane and proved quite unable even to maintain the body-weight of the rats where it was used as the sole source of nitrogen in the diet. When used in conjunction with 3 per cent lysine the body-weight still decreased; with 3 per cent tryptophane, the body-weight was maintained but not increased; and with both tryptophane and lysine normal growth was obtained. The two latter substances could be supplied either in their pure form or by the addition to the diet of such other proteins as edistin, lactalbumen or casein, so long as these were added in sufficient quantities to supply the required lysine and tryptophane.

2. — The maize grain contains 14.57 per cent of proteins, of which 6 per cent is zein and 4.5 per cent is maize glutelin. Rats fed on diets having maize glutelin as the only form of protein made perfectly normal growth, but on a diet in which the proteins were zein and maize glutenin in approximately the proportion of 2 to 1, very slow growth was obtained, and even when the proportions were as 1 to 1 growth was retarded; vetch legumin and phaseolin proved less effectual than maize glutenin in supplying the deficiencies of zein.

Lactalbumen added in the proportion of 20 per cent to the 2 to 1 mixture of zein and maize glutelin produced normal growth, as did larger quantities of casein and edestin, and the writers suggest that it may prove of great value in ordinary feeding practice, in cases where maize is used

as the only concentrated food, to add small quantities of other substances which will supply the indispensable amino-acids deficient in maize.

73 – **The Suppression of Growth and the Capacity to Grow.** — OSBORNE, T. B., and MENDEL, L. B. (Connecticut Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XVII, No. 1, pp. 95-106. Baltimore, Md., June 1914.

A number of normal half-grown rats were fed on various diets known to suppress growth or even to cause the body-weight to decline. The rats were kept under these conditions for periods much in excess of the time usually employed to attain full growth, and were then transferred to normal perfect nutrient diets, when their capacity for growth immediately reasserted itself vigorously and their growth curve followed the normal growth curve or even ascended more rapidly than the latter. This evidence lends no support to the general belief that growth is an exclusive property of young animals and that recovery is never complete after a prolonged period of stunting, owing to malnutrition during youth.

74 – **Observations on the Isolation of the Substance in Butter-Fat which Exerts a Stimulating Influence on Growth.** — MC COLLUM, E. V., and DAVIS, M. (Wisconsin Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 2, pp. 245-250. Baltimore, Md., October 1914.

It has previously been shown by the writers and other investigators that growth cannot be maintained on a diet containing no fat and that the essential element for growth is not contained in all fats and oils ; olive oil does not contain it, while butter-fat does. In the present set of experiments, butter-fat was first completely saponified by treatment with a mixture of absolute alcohol, petroleum ether and alcoholic potassium hydroxide ; olive oil was then shaken up with this solution of butter-fat soaps, after which the liquids were allowed to separate out; the soap solution was drawn off, the ether-olive oil layer was well washed and the ether was evaporated in vacuum. Olive oil thus treated was then fed to rats at the rate of 3 per cent of their diet, and proved to have the same stimulating effect on growth as butter-fat itself.

75 – **Studies on the Physiology of Reproduction in the Domestic Fowl. VIII : On some Physiological Effects of Ligation, Section or Removal of the Oviduct.** — PEARL, RAYMOND, and CURTIS, MAYNIE B. (Maine Agricultural Experiment Station) in *The Journal of Experimental Zoology*, Vol. 17, No. 3, pp. 395-423. Philadelphia, Pa., October 5, 1914.

The investigations conducted for some years at this Laboratory on the physiology of egg production in domestic fowls led to the following results:

1. Albumen secretion is not confined, as was formerly supposed, to the albumen-secreting region of the oviduct, but also takes place in the uterus.

2. Very probably for any part of the oviduct the effective stimulus is mechanical. If an artificial yolk (made of rubber, etc.) were introduced into the oviduct it would be enveloped by albumen and shell like the natural yolk coming from the ovary.

3. The amount of secretion by the duct depends in part upon the intensity of stimulation. Within the eggs of the same individual, the weight of albumen is highly correlated with the weight of the yolk, and the weight of the shell is insignificantly positively correlated with the weight of both albumen and yolk. In yolkless, single, double and triple yolked eggs the weight of albumen and shell is directly related to the number of yolks contained.

4. The muscular activity of the walls of the oviduct is undoubtedly responsible for the shape of the egg.

5. The resection of one-fourth of the albumen-secreting region and an end-to-end anastomosis of the remaining parts does not cause a permanent loss of function of the oviduct. Four months after such an operation a bird began to lay. The eggs were only a little below the average size for the breed and appeared to have a normal proportion of albumen.

In the present experiments the writers continued the observations and directed them specially to ascertaining the effect of operations or of mechanical action on the oviduct upon: *a*) the growth of the ovary and egg formation, *b*) the secondary sexual characters, *c*) the body metabolism, *d*) the growth and ability to function of any remaining part of the oviduct itself. A number of hens were operated, kept under observation for several years and then killed. From the experiments the following results were obtained:

1. That neither ligation, section, nor entire removal of the oviduct causes degeneration or prevents the further growth of the ovary.

2. The pressure exerted by the funnel is not absolutely necessary to ovulation, as the formation of the yolk takes place even when the oviduct is completely removed, or partly removed and the remaining parts sewn together.

3. There are hens with normal ovaries and apparently normal oviducts which do not lay any eggs because the mouth of the oviduct, through some anatomical or physiological defect, prevents the entry of the yolk into the oviduct.

4. The most important factor for the normal rupture of the follicle is probably the internal pressure caused by the continued formation of the yolk, as the closing of the funnel or the removal of the oviduct does not perceptibly delay ovulation.

5. The yolks ovulated into the body cavity cause, according to the constitution of the bird, its death or immediate or subsequent resorbtion by the peritoneum.

6. The yolks resorbed by the peritoneum are apparently utilized in the body metabolism, as all the hens in which this took place proved, on being killed, to be in good health and fat.

7. The removal of the greater portion of an oviduct does not cause atrophy of any remaining portion.

8. If after the passage of an ovulum from the ovary into the oviduct, the latter is closed at any level in order to prevent the passage of the egg,

the secretion of the duct takes place only in the portion of the duct in which the egg is situated.

9. When any portion of the ventral ligament is removed it is not replaced, but all remaining portions develop.

10. The forward portion of the ventral ligament is necessary for the reception of the yolk by the funnel, and the muscle bundles which arise from the muscular cord in the ventral ligament along the uterus are probably an important part of the normal apparatus which expels the egg.

As for the secondary sexual characters, the writers have shown that these are not altered by any operation or mechanical action upon the oviduct.

76 – **The Effect of Corpus Luteum Substance upon Ovulation in the Fowl.** — PEARL, R., and SURFACE, F. M. (Maine Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 2, pp. 263-278. Baltimore, Md., October 1914.

The corpus luteum substance employed in these experiments was a commercial product prepared by drying the fresh gland substance of cows and then treating it with petroleum-benzin and reducing the extracted material to a fine powder. Various amounts of a suspension of this substance were injected intra-abdominally into actively laying fowls; when doses of 1 gm. or 1.5 gms. were employed, ovulation was immediately inhibited for a period varying from a few days to three weeks, being afterwards resumed in a perfectly normal manner. Similar injections of the boiled substance proved ineffectual, while the unboiled substance was equally active when injected intravenously as when injected intra-abdominally, showing that the effect was due to a chemical substance and was not the result of the intra-abdominal operation.

77 – **Chemical Changes during Silage Formation.** — NEIDIG, R. E. (Iowa Agricultural Experiment Station) in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 11, pp. 2401-2413. Easton, Pa., November 1914.

Three silos were employed for an investigation of the chemical changes taking place during the formation of silage; they were built respectively of wood, of hollow clay tiles, and of concrete. The three silos were filled with maize, in an almost ripe condition, and during the filling, electric thermometers were buried in various points in order to enable temperature records to be made throughout the process. Sampling was carried out daily for the first ten days and then at longer intervals for about another ten days. Moisture determinations were made on the silage itself; samples of juice were drawn by means of an augur subjected to a pressure of 350 kg. per sq. cm. and analysed for sugar, volatile acids, lactic acid and alcohol; while samples of gases were drawn from the interiors of the silos and analysed for carbon dioxide and oxygen. The results are summarised in the adjoining table.

Analysis of silo contents during the formation of silage.

No. of sample	Age of sample	Silage	Juice				Gas
		Moisture content	Volatile acids	Lactic acid	Sugars calcul. as glucose	Alcohol	Carbon dioxide
	days	%	%	%	%	%	%
Wooden silo							
1.	0	76.3	—	—	5.20	0.01	1.4
2.	1	73.0	—	—	4.52	0.16	45.0
3.	2	67.6	0.44	0.76	2.78	0.39	66.4
4.	3	65.1	0.55	0.88	1.76	0.32	68.0
5.	4	66.0	0.56	0.64	2.01	0.29	52.0
6.	5	64.7	0.58	0.66	2.05	0.25	50.0
7.	6	66.5	0.61	0.77	2.44	0.20	55.0
8.	7	67.6	0.69	1.01	1.84	0.30	55.0
9.	8	67.5	0.64	0.57	1.80	0.31	55.0
10.	9	65.3	0.80	1.23	1.44	0.48	56.0
11.	10	68.3	0.57	0.99	2.05	0.19	46.0
12.	11	67.2	0.63	1.00	2.14	0.24	33.8
13.	17	65.6	0.65	1.61	1.30	0.37	32.4
14.	23	65.2	0.67	1.41	1.22	0.31	30.7
Clay-tile silo							
1.	0	64.3	0.03	0.16	4.59	0.02	26.7
2.	1	62.0	0.11	0.29	5.29	0.07	41.0
3.	2	65.5	0.12	0.22	4.75	0.11	48.0
4.	3	64.0	0.16	0.34	4.73	0.17	58.0
5.	4	57.9	0.30	0.29	3.38	0.20	48.0
6.	5	63.1	0.38	0.54	3.26	0.26	50.0
7.	6	61.2	0.38	0.57	2.84	0.30	48.0
8.	7	58.8	0.44	0.80	2.26	0.30	46.0
9.	8	60.9	0.46	0.65	2.28	0.29	40.0
10.	10	63.4	0.44	0.92	1.64	0.38	35.4
11.	12	62.3	0.53	1.11	0.05	0.46	31.1
12.	19	58.5	0.55	1.34	0.23	0.41	27.2
Concrete silo							
1.	0	59.0	0.01	0.00	9.04	0.02	63.0
2.	1	60.5	0.04	trace	8.94	0.20	73.0
3.	2	61.2	0.19	0.29	8.18	0.26	7.0
4.	3	58.6	0.28	0.51	7.09	0.24	80 5
5.	4	60.3	0.39	0.62	7.00	0.19	82.5
6.	5	62.0	0.48	0.74	5.57	0.30	75.0
7.	6	61.7	0.57	0.97	4.37	0.22	68.0
8.	7	63.4	0.61	1.01	4.07	0.27	66.0
9.	8	63.3	0.67	1.34	3.21	0.38	65.0
10.	10	64.5	0.70	1.17	3.37	0.30	56.0
11.	14	65.5	0.72	1.24	2.74	0.33	54.0
12.	21	65.6	0.74	1.41	2.56	0.37	40.5

It shonld be noted that the three silos were not filled with maize of absolutely uniform maturity, and moreover water was added to two of the silos, so that the results cannot be compared quantitatively, but only with regard to the general ratio of the chemical products obtained.

The juice in the green plants contained about equal parts of reducing and non-reducing sugars, but during the first few days after filling the silo, the non-reducing sugars disappeared, being replaced by reducing sugars, chiefly dextrose. The total sugars gradually decreased in amount from the time of filling of the silo, reaching a minimum in about twelve days. On the other hand, the total volatile acids, consisting of about nine-tenths acetic acid and one-tenth propionic acid with occasional traces of butyric and valeric acids, increased gradually during the process, as did the lactic acid and the alcohol. Gas analyses showed that carbon dioxide was formed very rapidly during the first few days and then decreased in amount ; oxygen on the other hand disappeared entirely after the first few days ; the residual gas consisted mainly of nitrogen, a considerable amount of which must have gained access to the silo from the top. Contrary to expectation the temperature readings showed no high maximum during the early periods of silage formation ; at the centre the temperature rose gradually from about 27° C. (80° F.) at the beginning of the process to 32° C. (90° F.) after 8 or 10 days ; towards the exterior the temperature was lower owing to conduction through the walls of the silo.

Within the limits of the investigation, no differences were noted which might be attributed to differences in the material of which the silos were constructed.

78 – **Punjab Cattle Census of 1914.** — HAMILTON, V. S. (Director of Agriculture and Industries, Punjab). — *Punjab Cattle Census of* 1914, 11 pp. Lahore, July 27, 1914.

STOCK RAISING: ORGANISATION AND ENCOURAGEMENT

The results of the last quinquennial cattle census in the Punjab, which was carried out between February 2nd and 9th, are summarised in the following table:

	1909	1914
Bulls and bullocks	4 233 133	4 579 061
Cows	3 368 589	3 669 089
Male buffaloes	634 576	562 601
Cow buffaloes	2 233 273	2 627 082
Young stock	3 789 789	4 041 230
Sheep	4 602 957	4 676 899
Goats	4 215 108	4 431 837
Horses and ponies	358 697	427 515
Mules	38 397	34 001
Asses	578 980	701 821
Camels	271 228	308 679

The increase in the number of cow buffaloes is due to the extension of canal irrigation. Cows are generally more valued as the mothers of bullocks than as milkers. The number of bulls and bullocks in relation to the cultivated area in the Punjab in 1913-14 was as follows :

Cultivated area	acres	27 736 701
Area of crop sown	»	27 328 403
Bullocks and buffaloes		5 141 662
Bullocks and buffaloes per 100 acres cultivated		19
Bullocks and buffaloes per 100 acres sown		19

The decrease in the number of buffaloes is a sign of the improvement in the conditions of the cultivators, as only the poorest ploughmen or carters use buffaloes, replacing them by bullocks as soon as their means allow them to do so.

The number of animals shows a good increase. As the grazing grounds are curtailed and the cost of fodder rises, the average quality of the young stock is improved by the sale of the inferior animals to the butchers.

During the last five years (1909-14), 788 470 cwt. of hides were exported from the Punjab, corresponding to 4 730 820 animals. The weight of a hide varies from about 8 lb. for a buffalo calf to 36 lb. for a buffalo. There have also been 452 936 cwt. of hides moved by rail from one part of the Punjab to another during the last 5 years. These represent 2 717 616 head of cattle. There is, besides, the local consumption of leather for shoes, well buckets, etc., which the writer values at 2 551 564 hides to bring up the total to about ten million hides that it may be safely said have been disposed of in five years.

Horse breeding is in a flourishing condition.

CATTLE

79 – **Skin Temperature and Fattening Capacity in Oxen.** — Wood, T. B., and Hill, A. V. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 252-254. Cambridge, May 1914.

In another paper (1) attention is drawn to the fact that wide differences occur between individual animals with regard to the manner in which they utilise the material supplied to them in food for laying on fat or for the production of heat. The suggestion was made that it might be possible to establish a relation between the fattening capacity of an animal and its skin temperature, because the difference between the skin temperature and the air temperature must bear a definite relation to the heat evolution. This suggestion was tested by measuring the skin temperatures of 18 oxen, which had been for more than two months on a diet of 6 lbs. of mixed linseed and cotton cake, 135 lbs. of roots and about 14 lbs. of straw chaff per head per day. The measurements were taken by means of a thermopile of simple construction : two wires, the one of copper and the other of constantan, each about 8 feet long, were soldered at one end to a small tin plate which was placed in contact with the animal's skin, at the other end to a large tin plate which was allowed to hang free so as to take up the temperature of the air ; leads were taken off to a galvanometer.

Preliminary experiments showed that the skin temperature was constant throughout a large area over the ribs behind the shoulder blade.

(1) See *B.* Dec. 1914, No. 1147. (*Ed.*).

The animals were driven as quietly as possible into the cage of the weigh-bridge. The tin plate, protected from draught by a muslin hood, was pressed firmly on to the hair covering the skin behind the shoulder blade. The needle of the galvanometer was watched until the deflection became practically constant, when the reading was recorded; constancy was generally reached in between five and ten minutes. The animal's weight was then recorded, and its rate of increase calculated from a weighing taken 21 days previously. The figures are given below:

Mark on animal	Average live-weight increase per week during last 3 weeks	Reading of galvanometer in scale divisions (1 scale division = 0.3° C. approx.)
	lbs.	
No. 3	25	65
1	24	73
7	22	61
2	21	73
4	15	64
10	15	82
9	15	65
13	15	71
Average of good "doers"	19	69
No. 20	14	79
5	12	65
15	12	80
14	11	77
12	10	67
Average of moderate "doers"	12	74
No. 6	8	72
19	6	83
11	5	81
18	5	79
17	0	77
Average of bad "doers"	5	78

In the table the animals are divided into three classes: good "doers", which had increased in live-weight more than 2 lbs. per head per day during the last three weeks; bad "doers", which had increased less than 1 lb. per head per day during the last three weeks; moderate "doers",

which had made increases intermediate between these extremes. The average figures for each class indicate that the animals which were making large increases had a lower skin temperature than those which were making small increases, the difference amounting to 9 scale divisions, which correspond to about 3° C. It is noticeable that every animal in the class of bad "doers" had a higher skin temperature than the average of the eight good "doers". The figures in the separate classes are not quite satisfactorily uniform, but some of the exceptions are readily explicable. For instance, the high temperature of the skin of No 10 was almost certainly due to his having exerted himself considerably whilst being driven from the yard to the weigh-bridge. The experiment can only be regarded as preliminary, but the results seemed to be of sufficient promise to be worth recording and with further refinements the method may be a valuable means of investigating fattening capacity.

80 – **Zebus in the State of Rio Grande do Sul, Brazil.** — MACHADO, SALVADOR PINHEIRO, in *A Estancia*, Year II, No. 17, pp. 205-208. Porto-Alegre, July 1914.

In order to demonstrate that Rio Grande do Sul possesses fine and large zebus the witer gives data concerning two slaughter-house tests conducted at Tupaceretan, municipality of Villa Rica, one with eleven head bred in the municipality of Santo Angelo, the other with seven bred in the municipality of Villa Rica. The live-weight of the former was: maximum 1665 lbs., minimum 1386 lbs., average 1496 lbs.; the offal (skin, hoofs, horns): maximum 176 lbs., minimum 99 lbs., average 136 lbs. For the second lot the maximum live-weight was 1903 lbs., the minimum 979 lbs., the average 1426 lbs.; the offal: maximum 194 lbs., minimum 106 lbs., average 159 lbs.

GOATS

81 – **The Grenada Goat.** — GIMENEZ, LUIZ, in *La Industria pecuaria*, Year XV, No. 462, pp. 377-378 + 2 figs. Madrid, November 10, 1914.

This race belongs to the brachycephalous type, having a flat forehead and slightly pronounced orbital arches. Typically both sexes are hornless. They are of average stature, 28 inches for she-goats and a little more for the he-goats. The predominant coat colours are chestnut and black; the hair is fine, short and silky; the udders are large and well developed, the bottle shape being considered the best type. The she-goats become serviceable at 6 months and may continue to breed to the age of 9 or 10 years, though they are not generally kept beyond 6 years. They mostly give birth to twins and sometimes triplets. The yield of milk is generally from 2.6 to 3.5 lbs. per day after the first parturition, the quantity increasing with subsequent lactations until the fifth, when it reaches its maximum at 13.2 to 14.1 lbs. The milk is excellent and without the characteristic odour of that of other breeds of goats. The flesh is also of good quality. The winter rations consist of 2 to 3 lbs. of beans per day (in three feeds) and olive prunings *ad lib.*, grazing being sufficient in summer. Small quantities of dried beet pulp are also fed. Epizootic diseases are rare in this breed owing to the system of breeding in permanent sheds. Finally, the Grenada goat is a fine early-maturing breed requiring considerable care.

82 – **Report on Egg-laying Competition, Queensland Agricultural College, 1913-14.** — *Queensland Agricultural Journal*, New Series, Vol. I, Part 5, pp. 321-323. Brisbane, May 1915. POULTRY

The tenth egg-laying competition held at the Queensland Agricultural College was brought to a close on March 31st. In all 40 pens of 6 hens each competed; they were made up as follows: White Leghorns, 34 pens; Brown Leghorns, 3 pens; Black Orpingtons, 2 pens; Red Sussex, 1 pen. The 240 birds laid during the twelve months 52 420 eggs, an average of 1310.5 per pen or 218.4 per bird. There were 129 broodies recorded — a very large percentage, but they were very easily put off.

The numbers of eggs laid were distributed as follows throughout the year:

April . . . 2719	August . . . 5345	December . . . 5223
May. . . . 3871	September . . 5300	January 4453
June . . . 3506	October . . . 5625	February. . . . 3643
July . . . 4462	November . . 5285	March 2988

The feeding consisted of the following rations: In the morning equal quantities of bran and pollard (by measure not by weight), together with 1 ¼ lb. sunlight oil cake and ¾ lb. of desiccated meat, mixed into a crumbly mass with water. Three quarters of a pint of this was fed each morning, about 6.30, except on Sundays, when oats were substituted. At 9 o' clock the pens were again visited to give more food to pens that needed it. This was found to be a better method than giving the full amount at once, with the result that perhaps some food would be left unconsumed. In January the desiccated meat was omitted from the ration and the laying fell off somewhat in consequence. At midday chaffed green lucerne was fed, a good handful to each pen, and about twice a week as much soup meat. The evening meal consisted of wheat, as much as the birds would eat up clean. Fresh clean water was given every morning and shell grit was at all times available in the pens.

83 – **On Inheritance of Weight in Poultry.** — PUNNETT, R. C., and BAILEY, P. G., in *Journal of Genetics*, Vol. IV, No. 1, pp. 23-39. Cambridge, June 1914.

For the investigation of the inheritance of weight, two breeds had to be selected which differed considerably in size but not sufficiently to prevent natural crossing; for motives of economy it was also important that none of the birds should be too large, and in view of these circumstances Gold-pencilled Hamburgs and Sebright Bantams were eventually chosen, the Hamburgs being about twice the size of the Sebrights.

A Hamburg cock was crossed with two Sebright hens, producing an F_1 generation of 8 males and 7 females of a fairly uniform size intermediate between that of the two parent breeds. The F_2 generation consisted of 233 birds raised to maturity, made up of 112 males and 121 females. In both sexes the range of size was considerable; allowing for sexual difference the range of variation was evidently similar in the two cases, and in each of them the weight of the largest bird was distinctly more than double the weight of the smallest; for each sex also the range of variation

was such that the smallest birds were smaller than the Sebright bantams while the largest were larger than the Gold Hamburgs. A pair of the largest birds were mated together; from them 13 males and 13 females were obtained. The offspring of these large F_2 birds varied a good deal in size but were all on the large side and nothing approaching a bantam was obtained. Two pairs of the smallest of the F_2 generation were also mated together. From one pair only 5 offspring were obtained, all small, while from the other pair 6 males and 7 females were reared, and, in both sexes, half appeared to be regular bantams and half rather larger birds. The F_3 results taken together suggested strongly that size in poultry depends upon definite factors and that these factors segregate in gametogenesis.

A few subsidiary tests were carried on at the same time: An F_1 cock ex Sebright × Gold Hamburg was crossed with two bantam hens, from which birds were obtained ranging from bantam size up to F_1 size. One pair of the smallest birds was mated up the following year and bred nearly true to size; their smallest offspring were again selected and tested the year after and produced nothing but bantams, showing that the original F_1 male ex Sebright × Hamburg must have produced some " bantam " gametes. Another pen of rather larger birds yielded variable offspring, some of which were regular bantam size while others were larger than their parents.

Another F_1 bird was run with the progeny (2 hens) of an artificial cross between a White Leghorn and a bantam which were about the same size as F_1 birds. A wide range of variation in size was obtained and the extremes tended to breed true to size.

A hypothetical explanation of the results is put forward in which it is assumed that four genetic factors are involved, each of which affects the weight of the bird and that when none of these factors are present the birds are of minimum size; further, that two of these factors, *A* and *B*, produce an increase of 66 per cent on the minimum size when the birds are homozygous and 38 per cent when the birds are heterozygous for either of them, while the remaining two factors, *C* and *D*, produce an increase of 30 per cent when the birds are homozygous and 25 per cent when the birds are heterozygous; and lastly, that the constitution of the Gold Hamburg is *AA BB CC dd* and of the Sebright bantam *aa bb cc DD*. Taking the minimum weight as 100 for birds of the constitution *aa bb cc dd*, the maximum weight for birds of the constitution *AA BB CC DD* becomes $100 + 66 + 66 + 30 + 30 = 292$.

The proportion and constitution of the different grades of the F_2 generation were worked out according to this scheme and actual weights to be expected were assigned to each grade on the basis of the range of variation found experimentally in the F_2 and F_3 generations. The experimental results were then interpreted in terms of the above scheme, which was found to cover the facts fairly closely.

It is pointed out as a feature of special interest that, according to the hypothesis put forward, two strains of intermediate and similar weight

are possible, *viz*: *AA bb CC dd* and *aa BB cc DD*. A cross between two such strains would result in F_1 birds rather larger than either, while F_2 would segregate out like the F_2 generation considered in the scheme. In other words a cross between two medium-sized strains of the same average size may lead in F_2 to the production of strains considerably larger and also considerably smaller than either of the parent strains, both of which can be readily fixed. It is possible that the great size of many floral varieties, *e. g.* daffodils, has been effected on these lines from crosses between medium-sized forms differing in constitution for the factors affecting size. It is not impossible that the increase sometimes observed on crossing strains of animals or plants of similar size is due not to increased vigour resulting from the cross, but to the bringing together of independent growth factors each capable of producing some effect. Were this the case it would be apparent in the F_2 generation, where fixable strains both larger and smaller than the parent forms should make their appearance.

The investigations are being continued.

84 – **The Inheritance of Bare Necks in Poultry.** — DAVENPORT, C. B., in *The Journal of Heredity*, Vol. V, No. 8, p. 374. Washington, August 1914.

Some three years ago the writer purchased two cocks and three hens characterized by the absence of feathers from the neck. Two of the hens had a paired bunch of feathers on the ventral side of the neck, but one was practically free from feathers and this condition has reappeared in her offspring. These birds are very sparsely feathered under the wings and over the sternum also.

Mated to each other these birds gave a few full-feathered chicks, but about three-fourths of all were bare-necked. Mated to ordinary fowls, about half of the offspring had naked necks.

It appears, consequently, that the bare neck is a typical dominant and that there is a factor in the " Bare Necks " which interferes with the development of the neck feathers. Probably, as the writer pointed out some years ago in connection with the condition of clean shank, every skin plate has the tendency to bear a feather, and if any portion of the skin is without feathers, it is due to a special factor inhibiting the development of feathers. Of these inhibitors there are probably a number; there are at least one for the shanks and one for the neck and possibly an additional one for the central patch of the neck. They are probably of the nature of an anti-enzyme, antagonistic to those enzymes which induce the formation of the feather.

85 – **The Artificial Fertilization of Queen Bees.** — JAGER, F., and HOWARD, C. W. (Minnesota Agricultural Experiment Station) in *Science*, Vol. XL, No. 1037, p. 720. Garrison, N. Y., November 13, 1914. BEES

During the past season a queen bee on emerging from her cell was kept in a three-frame nucleus in which no drones were present and which had a queen-excluder applied to the entrance. After five days fluid containing spermatozoa taken from the reproductive organs of a drone was in-

jected into the genital opening of the queen and she was then replaced in a queenless and droneless nucleus with a queen-excluder applied to the hive.

A week later the ovaries showed considerable development, as indicated by the size of the abdomen and a fortnight later still the queen began to deposit eggs and continued to do so for at least a month after normal queens had ceased to lay, over 3 000 eggs being laid in the time. This prolificacy was probably due to the stimulation given to the swarm by feeding, but it was remarkable that all the eggs produced worker bees, except four which produced drones. In every other respect, the brood, capping of the cells and resulting worker bees were perfectly normal.

Investigations on the swarm will be continued next season.

SILKWORMS

86 – **Report of the Italian Mission on the Search for the Best Breeds of Silkworms in China.** — I. MARI, BENITO; II. DONEGANI, EUGENIO, in *Bollettino dell'Ufficio di Informazioni Seriche del Ministero di Agricoltura, Industria e Commercio*, No. 3. pp. 27-43. Rome, June 1914.

The Italian Minister of Agriculture entrusted the writers with the mission of seeking in China new breeds of silkworms, which, while equal in fineness and price to European breeds, would show greater vigour on account of the more primitive way of breeding.

The first exploration was made in the interior of the province of Hupeh, where no Europeans except missionaries had ever been. The information gathered and the examination of a small number of cocoons led to the conclusion that this province raised a breed entirely unknown in Italy, with cocoons of various colours (white, gold, green, rose and straw-yellow). In the central part of the sericultural region of China alone, there are no less than thirty breeds and varieties of silkworms.

In the province of Hupeh a stick-like Geometer was noted feeding on mulberry ; it spins up among the dead leaves ; the cocoon is ½ to ¾ in. long and may be utilisable.

At Sientaochen DONEGANI visited a small mulberry farm kept by a Chinaman and obtained several cocoons. These were of two types : one, a bright rose colour, not to be confused with the rose-coloured breed from Hankow, which is already known in Italy but not appreciated, and a white breed. In shape it is slightly elongated but of excellent material, and the texture is beautiful, though a little coarse. Crossing these two forms would probably produce excellent hybrids, but without the perfect sphericity demanded and so much sought for by Italian breeders. However, in Chekiang, and more especially in the district of Shaoshing, at Saguew, the best centre of production in the district, a selected collection was made of about 50 lbs. of white cocoons of good consistence, spherical shape and very large size, all of them characters desired by Italian breeders for crossing. Spherical cocoons almost always originate in the country and each year tend to become more and more rare. Although the Chekiang cocoons are generally of a white colour, occasionally a small proportion are of a yellow or green colour.

Also at Soochow, one of the principal centres of production of cocoons of the province of Kiangsu, a fairly spherical type has been found, but not

so large as that of Saguew. The general type of cocoon is oval with a beautiful silver colour, and even texture of excellent consistence. At Mutu, where search was made for white spherical cocoons for breeding purposes, a small batch of cocoons was found in a native holding, which seemed to be of good quality, but in consistence and size they were somewhat inferior to those of Saguew. A large elongated cocoon of excellent consistence was also found and the writers propose to use it in hybridisation experiments.

87 – **On Occasional Parthenogenesis in *Sericaria mori*: First Experimental Contribution.** — FUSCHINI, C., in *Reale Istituto Superiore Agrario Sperimentale di Perugia*, pp. 5-19. Perugia, 1914.

The hatching of parthenogenetic eggs of the silkworm under the mechanical stimulus of a brush or by immersion for 2 minutes in sulphuric acid, has been reported by M. TICHOMIROFF. M. QUAJAT, as a result of experiments carried out in conjunction with M. VERSON and M. NUSSBAUM, considers that there is little probability of obtaining silkworms from the eggs deposited by unfertilised females. He attributes the results obtained by M. TICHOMIROFF to cases of artificial parthenogenesis. It was therefore desirable to begin new researches to determine whether the conditions of the larval life of the silkworm can exert an influence on the possibility of parthenogenetic development of the eggs of the females.

From the same batch of Italian silkworms, the writer isolated 25 females from the earliest larvae which were preparing to form cocoons and 25 from the latest. The two batches were separated so as to avoid all chance of mixing. The cocoons obtained were placed in separate gauze bags and hung from a wall. The temperature of the room was maintained at 24 to 25° C. All the eggs produced were numbered and half of each batch which included more than 100 eggs was treated with hydrochloric acid solution (2 parts of concentrated acid to 1 of water) and the other halves were kept as control.

The results of the observations have led to the following conclusions :

1. There is no notable difference between the moths of the same batch of larvae whether they are the earliest or latest in spinning their cocoons.

2. A considerable percentage of the moths die without laying eggs. The two lots of 25 larvae produced 46 females, of which 28 did not lay eggs.

3. The moths which produced eggs did so later than when fertilised, and the egg-laying was never complete.

4. Almost all the eggs kept as control kept their colour unchanged, thus showing the absence of any internal changes.

5. The eggs treated with dilute hydrochloric acid did not differ from the controls in these experiments and dried even more rapidly than the latter.

6. In a very small number of cases an incomplete yellowish-red coloration developed on the unfertilised eggs after considerable delay. These eggs, however, also dried in the same time or nearly so as those which retained their yellow colour.

These results therefore suggest the possibility of occasional parthenogenesis as a function of the environment conditions prevailing during

the larval stage. The writer intends to continue the experiments and to make careful comparisons with a small batch of the same cocoons.

FISH BREEDING.

88 – **Respiration and Metabolism in Fish.** — LINDSTEDT, PH., in *Zeitschrift für Fischerei und deren Hilfswissenschaften*, Vol. 16, Part 3, pp. 193-245. Berlin, 1914.

Respiration experiments carried out by means of the respiration apparatus constructed by ZUNTZ and KNAUTHE served to determine the metabolic processes in fish. In the first place, the oxygen used and the carbonic acid and nitrogen parted with were estimated, and from the values obtained, the total amount of substances utilised and the transformation of energy obtained from protein, fat and carbohydrates were calculated.

The writer used in his experiments tench, rainbow trout, pike and perch, fish which had hitherto not been employed in respiration experiments.

From the data given in the tables, it is seen that the exchange of gases in respiration depends on temperature; it increases when the body temperature rises, and diminishes when the latter falls. The normal limits of temperature within which the life processes of fish can go on were determined as 0° C. and 25° C. The amount of oxygen increases from 0° C. and, in the case of fasting three-year-old tench, rises from 6.05 cc. per kilo of weight and per hour at 0° C. to 100.34 cc. at 25° C. The taking-in of oxygen is parallel to the giving-out of carbonic acid, which in the case of the same fish amounted to 4.77 cc. and 88.54 cc. per kilo and hour.

From these and the intermediate values, it can be shown that the intensity of metabolism in fish also follows VAN'T HOFF'S law, *i. e.* that the rate of exchange doubles on raising the temperature 10° C. The experiment showed also that tench in water containing only 0.077 cc. of oxygen per litre, *i. e.* nearly devoid of oxygen, can live only a very short time, in spite of being able to use nearly all the oxygen in the water. The amount of the oxygen in solution in the water which the fish can use may vary within wide limits and reach 99 per cent.

If the amount of oxygen used and that of the carbonic acid given off by different large fish of the same species is compared, it is seen that the intensity of the exchange of gas does not correspond to the weight of the fish. Thus tench three summers old use at 15° C. 50 cc. of oxygen per kilo and hour, while tench only two summers old, use 69 cc. and those of one summer 103 cc. The same thing is to be observed regarding the amount of carbonic acid given off. Tench three summers old gave off 41.5 cc. per kilo and hour (at 15° C.), while tench of two summers and those of one exhaled respectively 50 cc. and 90.3 cc. of carbonic acid. With regard to the consumption of oxygen per surface unit in the case of different large fish of the same species, the writer states that only very small differences exist. Calculated according to the surface unit (1 square decimeter) the oxygen consumption by the three-season tench varied only between 2.2 cc. and 2.9 cc., and in the case of the two- and one-summer old pike between 4.1 cc. and 4.9 cc. respectively.

Thus the law that respiration intensity is directly proportional to body surface, proves to be true for the fish examined by the writer, as well as for warm-blooded animals.

If fish of different species are compared, a great difference of consumption is observed, even where the surface area is the same. Thus tench use 2.11-2.95 cc. of oxygen per unit of surface and hour, perch 3.02 cc., pike 4.07-4.88 cc. and rainbow trout 12.67 cc. According to KNAUTHE, carp use twice as much oxygen as tench. The intensity of respiration differs in each species of fish quite independently of their mode of life (whether predatory or non-predatory).

Crabs seem to need still less oxygen than tench. It is not universally true that warm-blooded animals require more oxygen than fish, for the experiments proved that, under certain circumstances, the latter need more of this gas per kg. of live-weight than do the former.

In warm-blooded animals and fish alike, the consumption of oxygen increases sensibly after feeding. The same increase is noticeable at the season of reproduction. Thus in pike which were examined before, during and after spawning time, a notable increase in the consumption of oxygen was observed, together with much more intense transformation of energy. Crabs, during the mating season, use twice as much oxygen as at other periods.

89 – **The Effect of Mosquito-destroying Solutions upon Aquatic Animals and Birds.** — *Mitteilungen des Fischerei-Vereins für die Provinz Brandenburg*, Vol. 6, No. 7, pp. 82-83. Berlin, September 1914.

The German Imperial Sanitary Authorities have made experiments upon the effect on aquatic animals and birds of mosquito-destroying solutions and have obtained the following results.

Petroleum has no poisonous effect upon the lower animals living in the water, but the soluble components of Saprol, carbolic-free Saprol, Larviol A and Larviol B, when they find their way into the water, are poisonous in different degrees. Saprol kills all the animals living in the water, but it appears, according to experiments with dilute solutions, that their poisonous properties cease at a depth of 10-13 feet. Carbolic-free Saprol is scarcely to be distinguished in its effects from Saprol. Larviol A and Larviol B are less injurious to aquatic animals, and their effect begins to cease at a depth of 20 inches, or even less.

Petroleum only destroys such aquatic animals as it can suffocate by obstructing their respiratory organs. The damage done to the lower forms of animal life by treating stagnant water with Saprol is not greater than the injury wrought by the natural drying up of many ponds which occurs nearly every year, once or repeatedly. There is therefore no more question of the absolute destruction of the lower fauna by the use of Saprol, than there is by the ponds drying up.

The experience of those engaged in practical mosquito control has shown that native birds, game, or domestic animals which happen to drink water covered by a layer of Saprol, petroleum, etc., are in no wise harmed.

Thus the objections raised in the interests of the protection of wild birds against treating sheets of water with petroleum and Saprol are unjustified according to the evidence at present available.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

90 – **Review of the Trials of Motor Tillage Machines carried out during the Year 1913.** — *Landwirtschaftliche Maschinen und Geräte.*, No. 20, pp. 15-23. Artern, Province of Saxony, May 16, 1914.

A great number of trials of motor tillage machines were held in various parts of the world during 1913. Of these about twenty were of much more than local importance ; they were held in the following places :

In Europe : Arras, Grignon, Soissons and Trappes in France ; Chassart in Belgium ; Ciulnitza in Rumania ; Galanta in Hungary ; Kent in England ; Kieff and Petrograd in Russia ; Komotau Hagensdorf and Litowitz in Bohemia ; Lowenhagen and Klein Wanzleben in Germany ; Colorno, Parma, in Italy. Especially important were the trials at Grignon and Trappes, as they were arranged and subventioned by the Ministry of Agriculture and were intended to extend over several years.

In Africa : Port Elizabeth in Cape Colony ; Algiers in Algeria, and Tunis.

In America : Winnipeg in Canada.

During the above trials 66 different machines were tried. Of this number 12 were steam traction engines hauling gang ploughs, 26 benzine traction engines drawing gang ploughs, of which 2 with wheels running on endless belts, 10 benzine motor-ploughs, 3 two-engine motor outfits, 2 motor outfits on the towing system, 1 motor digger, 2 motor gang ploughs combined with windlasses, 1 motor gang plough with endless belt, 3 motor tillage implements, 2 round about outfits, 5 motor rotary soil pulverizers.

The 58 firms whose machines were tried were the following :

American firms (11) : Avery Co. *Peoria, Illinois;* J. I. Case Threshing Machine Co. *Racine, Wisconsin;* Emerson Brantingham Co. *Rockford, Illinois;* Fairbanks, Morse & Co., *Chicago Ill.;* Hart Parr Co. *Charles City, Iowa ;* International Harvester Co. (I. H. C.) *Chicago, Ill. ;* Holt Caterpillar Co. *Peoria, Ill.;* A. S. Lascelles & Co. *New York;* Minneapolis Steel & Machinery Co. *Minneapolis, Minnesota ;* M. Rumely Co. *La Porte, Indiana ;* Western Implement and Motor Co. *Davenport, Iowa.*

Austrian firm : Erste Böhmisch-Mährische Maschinenfabrik, *Prague.*

Canadian firm : Sawyer & Massey Co. Ltd., *Hamilton, Ontario.*

English firms (9) : Ch. Burrell & Sons Ltd. *Thetford ;* Clayton & Shuttleworth, Ltd. *Lincoln ;* Ivel Agricultural Motors Ltd. *Biggleswade ;* Ideal Agricultural Motors Ltd. *London ;* Marshall, Sons & Co. *Gainsborough ;* J. & H. Mc Laren *Leeds ;* Ransomes, Sims and Jefferies Ltd. *Ipswich ;* Ruston Proctor & Co. Ltd. *Lincoln ;* Saunderson & Mills *Bedford.*

French firms (12) : A. Bajac, *Liancourt (Oise)* ; Eugène Bouche, *Chesnay près Versailles (Seine-et-Oise) ;* M. Benedetti, *Le Mesnil-Aubry (Seine-et-Oise)* ; Derguesse-Tourand, *Levallois-Perret (Seine) ;* De Dion-Bouton, *Puteaux (Seine)* ; V. Doisy, *Vauves (Seine)* ; Georges Filtz, *Juvizy (Seine-et-Oise)* ; La Motoculture Française, *Paris ;* Lefèbvre, *Rouen (Seine-et-Oise)* ; Maillet, *Laiz par Pont de Veyle (Ain)* ; de Mesmay, Veuve, *Saint Quentin (Aisne)* ; Vermont Quellence, *Paris.*

German firms (13) : Aktien Maschinenfabrik Kiffhäuserhütte, *Artern ;* Deutsche Kraftpflugfabrik, *Berlin ;* J. Kemna, *Brelau ;* Lanz, *Mannheim ;* Paul Heinrich Podens, *Wismar ;* F. Komnick, *Elbing ;* Münchener Motorenfabrik, *Munich-Sendling ;* G. Pöhl, *Gössnitz (Sachsen-Alten-*

burg) ; Schröder & Wurr, *Berlin ;* Süddeutsche Industrie Gesellschaft m. b. H., *Karlsruhe ;* Standard Motorpflug fabrik g. m. b. H., *Berlin Charlottenburg ;* Stockmotorpflug Gesellschaft m. b. H., *Berlin ;* Theodor Kaulen, *Berlin.*

Hungarian firms (4) : Koszegi Gépgyár Rèszvèny Társulat, *Budapest ;* Magyar Motorèsgèpgyár, *Szombathely* (*Steinamangar*) ; Schlick-Nicholson Gèpgyár, *Budapest;* Magyar Àllamoasutak Gèpgyára, *Budapest.*

Italian firms (7) : Alberto Baroncelli, *Ravenna;* Francesco Casali & Figli, *Suzzara* (*Mantova*); Pavesi Tolotti & Ci., *Milan ;* Giovanni Montini, *Orvieto ;* Officine Otav, *Grumello del Piano, Bergamo ;* Violati-Tescari, *Ariano Polesine.*

As means of rendering machine tillage popular and of allowing experts to became acquainted with the different systems, the above trials were decidedly useful, but a good many years of further practical trials will be necessary before it can be finally settled which of the many machines on the market are the most suitable for the various soils and conditions.

On the whole, the various machines, fitted with ploughshares, may be roughly divided into three groups : the Anglo-American, the German and the Franco-Italian. The chief type of the first group is the common traction engine and gang plough, which appears to be the most suitable to the conditions obtaining on the American continent, in the colonies and, in Europe, in Rumania, Russia and Hungary. For these conditions a 60 to 70 HP engine with an 8- or 10-share gang plough capable of ploughing 2 ½ acres per hour to a depth of 7 inches seems the most suitable.

To the second group belong machines in which the motor is connected with the plough and forms with it a rigid or semirigid whole, as in the Stock plough. This group has about 50 HP motors, it ploughs about 1 ½ acre per hour to a depth of about 8 inches and is adapted to medium-sized farms. This type has gained a solid footing in Germany and has spread to a certain extent in other countries also.

The third group has no special type; it includes small motor ploughs of about 20 HP, traction ploughs with or without the use of wire ropes, with 20 to 30 HP tractors as well as round about outfits. It is especially suitable to the small farms of France and Italy.

91 – **Thomson's Turnip Picker and Cutter.** — *The Implement and Machinery Review* Vol. 40, No. 470, p. 237. London, June 1, 1914.

This is a machine for picking up, elevating and cutting turnips, mangolds, or other root crops and delivering them in a neat line on the ground in one operation ready for feeding sheep or cattle. With a labourer and two horses it is claimed that it will lift and cut six acres of roots per day. The chief feature of the machine is a large roller covered throughout its circumference with small closely set tines for picking roots off the earth. The tines also carry the roots round into a hopper at the front of the machine, where they are cut up and delivered on the ground by a shaker as the machine travels along.

For those who wish to cart away the roots for feeding elsewhere, the picker and cutter will be fitted with an elevator for loading drays or wagons,

in which case the machine will be provided with suitable connection for attaching such vehicles.

The new picker was invented in New Zealand and, after a working trial in an agricultural show in that colony, it was awarded a gold medal.

92 – **Martin's Potato Sorter.** — *The Implement and Machinery Review*, Vol. 40, No. 475, p. 890. London, November 1, 1914.

The accompanying figure represents the potato sorter made by the Martin's Cultivator Co. Ltd., of Stanford, England.

With this machine the potatoes may be sorted into three sizes, whilst the earth adhering to them falls to the ground. The riddles are of the flush-top kind, a form least likely to cause any of the skin to be taken from the potato. The upper riddle measures 3ft. 6 in. by 2ft., while the lower one is 2ft. 10 in. long. On turning the handle of the machine these riddles are given a spring-controlled combined rocking and reciprocating motion. The machine can be stored away in a small space, since the hopper can be folded over and the side spouts are detachable. The whole being mounted on wheels, it can be easily moved by one man.

Its price is £ 8.

93 – **The Newton Fruit-Grading Machine.** — *The Implement and Machinery Review*, Vol. 40, No. 478, p. 1008. London, December 1, 1914.

The accurate grading of fruit is being more than ever insisted upon in both fruit-producing and fruit-consuming countries; consequently this grader, which, it is claimed, grades apples, plums, tomatoes, gooseberries, etc., with mechanical accuracy and without any injury, will be received with interest.

It consists of a conveyor band, passing over a pulley at each end, which carries the fruit along a padded surface. Motion to the band is imparted by a crank handle on the spindle of one of the pulleys. On the same spindle is a large pulley round which passes a leather belt that drives the grading rollers at varying heights above the conveyor band. The grading rollers are covered with felt and have spirals on them for correctly grading the fruit.

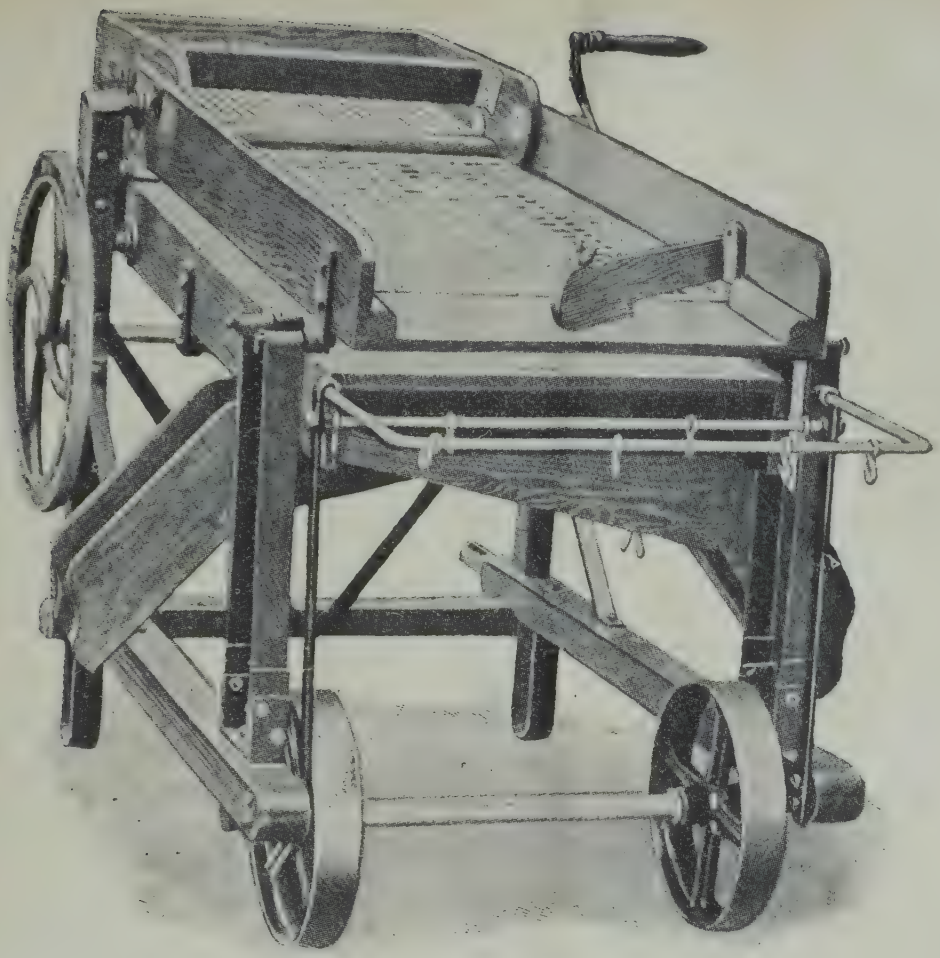
The fruit is fed to the conveyor from the hopper-shaped table seen on the right of the accompanying illustration.

The first grading roller, being highest above the band, deflects the largest fruit on to the first table, and allows the smaller fruit to pass underneath to be similarly dealt with by the succeeding rollers.

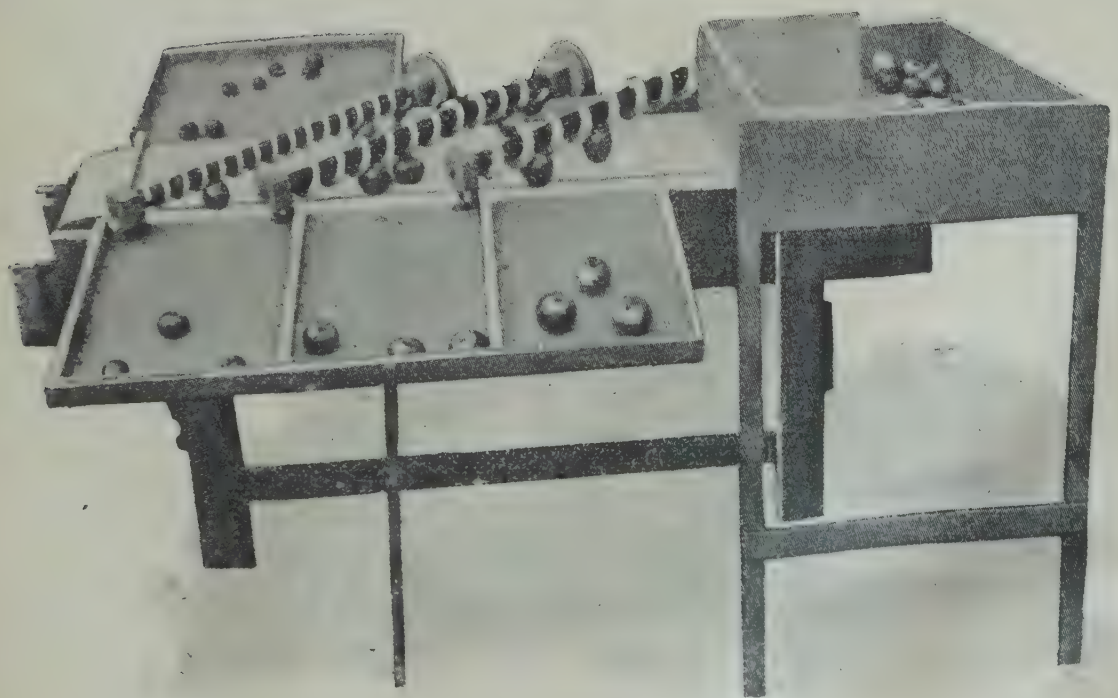
The machine, with the tables folded, measures 2ft. by 6½ ft. and weighs 140 lbs. Its price is £15 and its rated capacity is 15 cwt. per hour.

94 – **Cream Separator Industry in Sweden.** — HARRIS, ERNEST L. (Consul general, Stockholm), in *Daily Consular and Trade Report, Bureau of Foreign and Domestic Commerce, Department of Commerce*, Year 17, No. 69, p. 1115. Washington, March 24, 1914.

The manufacture of cream separators has become an important Swedish industry. Many separator factories have branch factories and selling agencies in almost every country in the world. Sweden, however, still



MARTIN'S potato-sorter.



NEWTON'S fruit-grader.

does a thriving export business in these machines. Statistics for 1913 are not yet available, but those for 1911 and 1912 show the extent of the foreign trade :

Country	1911	1912	Country	1911	1912
	$	$		$	$
Russia	1 093 608	1 088 657	Denmark	50 653	67 343
Germany	668 382	732 687	United States	50 028	66 622
Australia	504 736	504 736	Netherlands	48 574	37 921
France	253 346	180 346	Argentina	45 193	45 543
Austria	196 375	211 550	Brazil	27 380	17 353
Finland	195 555	178 584	Hungary	25 085	26 532
Norway	170 277	159 984	Italy	22 792	35 755
England	82 627	200 366	Canada	17 076	17 075
South Africa	55 720	55 720	Other countries	41 123	46 399
Belgium	55 030	54 138	Total	3 003 560	3 727 311

95 – **Apparatus for Irrigating by Overhead Sprinkling.** — *Landwirtschaftliche Maschinen und Geräte*, No. 27, pp. 24-27 + 4 figs. Artern, Province of Saxony, July 4, 1914.

The following sprinkling apparatus were tested by the German Agricultural Society during 1914 :

I. The " Pluvius system ", patented in Germany under No. 255220.

The water is raised and driven by a high pressure pump into a main, from which lateral pipes, parallel to each other, branch off every 650 to 800 feet. At right angles to the latter and 82 feet apart, paths 1 foot 8 inches wide are set out for the passage of the sprinkling trucks, which are connected with the lateral pipes by lengths of light hose. On opening a cock the water enters the trucks and issues from the horizontal pipe, which is mounted on each truck, in a fine rain which covers an area of $82 \times 33 = 2706$ square feet. The truck is kept about half an hour in one spot and then shifted about 33 feet further along the path in order to irrigate another patch of 2706 sq. ft. In 14 hours one truck delivers about one inch of rain over 1 $^3/_4$ acres.

For the watering of 50 to 60 acres, six such trucks are sufficient; they can be attended to by two men, besides one man at the central pump. The horizontal pipe can turn completely round on its support so that the truck can easily pass between rows of trees and the like. The weight of each truck is about 440 lbs. and its price about £ 15. The total cost of the plant for a farm in level country, 250 acres in extent, with a 5-inch main, amounts to about £ 900 without the engine.

II. The "Eisener" sprinkling truck, patented in Germany under No. 271716.

In this system the water is raised and driven into a main at a pressure of from 4 to 6 atmospheres. The main is provided with hydrants at regular distances apart and two or four sprinkling trucks are connected by pieces of hose with each other and with the hydrants. Each truck carries a system of sprinkling pipes, namely one long pipe which lies crosswise to the truck and four shorter pipes across the long one. At each end of the cross-pipes and at the intersection of these with the long one, a double nozzle — revolving by the recoil of the issuing water — is situated ; thus each truck bears twelve such double nozzles, and when the water is turned on it irrigates 4 300 sq. ft. of land at a time at the rate of 2.4 to 3.6 inches per hour. The trucks are kept 15 to 20 minutes in one position and then all of them together are hauled 50 to 60 ft. forward by a wire rope worked by a winch ; then the water is turned on again and another area of 4 300 sq. ft. is watered. The wire ropes are about 1300 ft. long. The winch is worked by two men or by a draught animal. If the land to be watered is longer, the winch, which is also mounted on a truck, is shifted.

On each truck the long pipe is mounted on a swivel connection, so that it can turn right round, and the cross pipes can fold back along the long pipe, thus allowing the truck to pass between trees, through gates, etc.

The cost of a complete outfit for a farm of about 250 acres in extent is about £ 833, without the engine.

III. Another irrigation outfit tested was "Hartmann's system", patented in Germany under No. 233 908. It resembles the preceding ones in the main with water under pressure and sprinkling-trucks — these differ somewhat in construction from those of the other systems — which are drawn by a winch and wire rope in a direction parallel to the main. The latter is shifted when a strip 260 ft. wide has been watered. Every outfit consists of four trucks, each capable of sprinkling 4 300 sq. ft. at a time, at the rate of about 2 inches per hour. This plant is sufficient for 370 acres and costs about £735.

In all three systems the farms are assumed to be nearly square in shape and to have the pumping-station at about the centre of one of the sides.

96 – **Review of Patents.**

Tillage Machines and Implements.

Austria	67 621.	Device for fixing the body of ploughs, especially in motor ploughs.
	67 625.	Tillage machine with revolving drum carrying hoes.
	67 759.	Plough share.
Canada	155 999.	Plough.
	156 050.	Self-propelled plough.
	156 144.	Plough hitch.
	156 195.	Harrow.
	156 305.	Cultivator.
	156 355.	Rotary harrow.
	156 361.	Digging machine for post holes.
	156 437.	Hoe.
	156 516.	Gang plough mechanism.

Canada
156 543. Motor plough mechanism.

Denmark
19 297. Beet hoe.
19 308. Combined horse-hoe and rake.
19 323. Horse-hoe.

Germany
278 626. Driving wheel with adjustable cleats worked by screws, for motor ploughs and the like.
278 627. Wheel guard for motor vehicles, especially motor ploughs.
278 628. Motor plough with arrangement for lifting plough frame.
278 629. Traction engine, especially motor traction engines with two vertical windlasses.
278 630. Ploughing outfit in which the plough is hauled towards the motor by a cable and is driven back, not working, by an electromotor mounted upon it.
278 631. Hoeing machine.
278 682. Wheel for ploughs and the like.
278 683. Anchor truck for machine ploughs.
278 802. Subsoiler attachment for ploughs.
278 909. Tree stump puller.
278 969. Garden and field rake.
279 035. Plough with subsoil packer, roller-harrow and disk-coulter.
279 156. Adjustable levelling roller.

Italy
135 551. Motor digging machine.
139 359. Improved plough.
142 304. Motor digger.
142 614. Plough for the automatic breaking up of the ridges in vineyards.
144 079. Machine hoe for weeding rice-fields.
143 965. Device for raising or lowering the frame of motor ploughs in relation to the steering wheel.

Sweden
37 289. Folding harrow.
37 372. Harrow.
37 439. Plough and subsoiler.
37 152, 37 474. Rotary harrow.
37 597. Excavating screw for ditching plough.

United Kingdom
13 503. Motor cultivator with implements mounted on rotating drum.
14 239, 14 449. Cultivators.
14 358. Machine for cutting bracken, etc.
14 507. Apparatus for lifting and lowering front end of gang plough frames.

United States.
1 110 471, 1 111 231, 1 110 393, 1 111 378, 1 113 563, 1 114 117, Cultivators.
1 110 846. Folding harrows.
1 112 079. Gang plough.
1 111 908. Weed cutter.
1 111 940. Ground leveller and moisture retainer.
1 112 267, 1 113 806. Motor ploughs.
1 112 215. Ditching plough.
1 112 148, 1 112 149, 1 112 150, 1 113 150, 1 113 047, 1 113 494, 1 113 982, Ploughs.
1 112 241. Stubble burner.
1 112 499. Soil pulveriser.
1 113 141. Land roller.
1 112 474. Harrow and land leveller.
1 112 998. Stump extractor.
1 113 219. Harrow and pulverizer.

United States
1 113 501. Wheeled plough.
1 113 378. Land marker.
1 113 241. Double disk-harrow.
1 113 906. Combination plough and drill.
1 114 687. Landside protector for ploughs.
1 114 462. Harrow.
1 114 692. Reversible plough.
1 114 310. Cultivator attachment.

Manure distributors.

Sweden
37 548. Manure spreader.
United States.
1 112 256. Manure spreader.
1 111 895, 1 114 211. Fertiliser distributors.

Drills and sowing machines.

Denmark
19 408. Potato planter.
Sweden
37 290. Drill.
37 511. Seed distributor for drills.
37 630. Device for drills.
United States
1 111 175. Seeding machine.
1 111 602, 1 110 935, Planting machines.
1 111 220, 1 113 802, 1 114 385, Corn planters.
1 111 223. Marking and checking attachment for corn planters.
1 111 960. Seed feeding mechanism for planters.
1 112 962. Seeder and planter.
1 114 156. Single disk furrow opener.
1 114 495. Attachment for seed planters.

Reapers, mowers, etc.

Austria
67 940. Scythe fastener.
Canada
156 630. Mower and harvester mechanism.
Cuba
2 090. Apparatus for cutting grass.
France
470 498. Improvements in horse rakes.
Germany
278 803. Swath rake that can be used as a tedder.
278 804. Apparatus for collecting sheaves with binders working in square fields.
278 906. Blade holders for mowers.
278 907. Guide for knife in mowers.
Italy
143 277. Improvements in machines for milling flax.
Sweden
37 441. Coupling for driving and road wheels in reapers.
37 551. Hay stacking machine.
Switzerland
67 369. Improvement in tedders.
United Kingdom
14 776. Swath turner and collector.
14 914. Machine for trimming the edges of lawns, collecting grass and rolling gravel.
15 267. Tool for cutting, gathering and lifting peas, etc.
United States
1 110 502. Corn cutter.
1 111 081, 1 111 757, 1 112 115, 1 113 552. Mowing machines.
1 110 785. Cotton stalk puller and cutter.
1 110 344. Cabbage harvester.
1 111 853. Bean harvester.
1 111 925. Stalk cutter.

United States 1 113 255, 1 113 857. Corn harvesters.
1 113 697. Grain binder.
1 113 602. Harvester reel.
1 113 853. Grass distributor for mowers.
1 113 988. Hay and grain stacker.
1 114 133. Grain shocker.
1 113 944. Cutter for mowers, reapers, etc.
1 114 416. Bean gathering machine.

Machines for lifting root-crops.

Austria 67 735. Beet lifter.
67 740. Revolving disk-shaped screen and conveyor for potato lifters.
Denmark 19 300. Potato digger.
19 359. Potato harvester.
Germany 278 805. Potato harvester.
278 908. Throw wheel for potato lifter.
Sweden 37 288. Beet and other root-lifting machine.
37 549. Potato-lifting machine.
37 765. Beet-topping machine.
United Kingdom 13 873. Potato harvester.
United States 1 111 210, 1 114 390. Beet pulling and topping machines.
1 110 538. Harvester for beets and other root crops.
1 112 344, 1 113 505. Beet harvesters.
1 113 761. Potato digger elevator.

Threshing and winnowing machines.

Brazil 9 091. Improvement in elevators in threshing machines.
Canada 156 593. Grain separator.
Germany 278 684. Blower for short straw in threshers.
278 742. Grain-cleaning apparatus for threshers.
278 743. Straw shakers suspended on oblique springs for threshers.
Italy 142 903. Sifting and grading machines.
143 343. Device for separating stones, foreign matter and refuse from grain.
144 115. Driving gear for straw elevators in threshers.
Sweden 37 550. Shaker for threshers.
United Kingdom 13 558. Feeding device and band cutter for threshing machines.
United States 1 112 194, 1 111 554, 1 110 768. Threshing machines.
1 110 950. Automatic feeder for threshing machines.
1 111 262. Threshing cylinder.
1 111 856. Corn husker.
1 112 232. Corn saving and cleaning device.
1 112 845. Grain separator.
1 112 685. Seed cleaning and separating machine.

Machines and implements for the preparation and storage of grain and fodder.

Austria 67 729. Device for binding straw and the like.
Canada 156 492. Hay distributor.
Denmark 19 293, 19 495. Straw presses.
Germany 278 744. Straw press.
Sweden 37 631. Device for straw press.

United States	1 111 819, 1 113 064. Baling presses.
	1 110 469. Shock loader.
	1 113 000. Hand-power hay baler.
	1 112 701. Hay cutter.
	1 113 809. Silo filler.

Dairying machines and implements.

Brazil	9 047. Churn.
Canada	156 101, 156 574. Milking machines.
	156 008, 156 398. Cream separators.
	156 611. Churn.
Denmark	19 324. Apparatus for fixing the tails of cows during milking.
	19 329. Apparatus for lifting and emptying milk cans.
	19 332. Apparatus for pasteurising milk.
	19 356. Revolving cheese shelf.
Germany	278 806. Differential planet gear for churns.
	278 807. Milking machine with each teat cup mounted on an adjustable arm.
Sweden	37 291, 37 596. Devices for milk separators.
	37 678. Device for milking machine.
	37 717. Milking machine.
	37 195. Improvements in drum of separators.
Switzerland	67 425. Apparatus for pasteurising milk.
	67 578. Device for facilitating the handling of cheeses.
United Kingdom	14 249, 14 256. Appliances for sterilising milk.
	14 416. Butter churns.
	14 616. Apparatus for sterilising, pasteurising or concentrating milk.
	14 961. Receiver and measurer for milking machines.
	15 213. Teat-cup for cow milkers.
United States	1 111 978, 1 112 949, 1 113 942. Milking machines.
	1 113 170. Cow milking apparatus.

Other agricultural machines and implements.

Austria	67 736. Apparatus for destroying insects injurious to hops.
Brazil	9 025. New water wheel with constant level.
	9 072. Windmill for raising water.
	9 073. Motor driven by currents of air.
	9 102. Device for forming powerful waterfalls.
Canada	155 943. Tobacco-stemming machine.
	155 956. Poultry feeder.
	156 164. Device for locating water.
	156 254. Rossing machine.
	156 269. Door opener for poultry houses.
	156 274. Improved trap nest.
	156 401. Centrifugal apparatus for purifying sewage.
	156 472. Machine for shearing sheep-skins.
	156 482. Ventilator for barns.
	156 545. Apparatus for purifying oil.
Cuba	2 088. Improvements in sugar mills.
	2 107. Apparatus for washing sugar in centrifugal baskets.
	2 097, 2 098, 2 103. Centrifugal separators.

Germany.	278 801.	Device for driving agricultural machines by electricity.
	278 809.	Device for untying animals.
	278 910.	Hose truck.
	278 970.	Implement for fixing posts, consisting of a double hook and pedal.
Italy	142 025.	Hydraulic press for vinasse and the like.
	143 222.	Sprinkler for vineyards, gardens, etc., with regulator.
	143 000.	Continuous sprayer.
	142 806.	Apparatus for fumigating, disinfecting, deodorising, etc.
	143 163.	Machine for extracting the juice and essential oil of citrus fruit.
	142 393.	Force pump for raising and distributing through pipes dense liquids and pasty matters, especially crushed grapes with or without stalks.
	140 853.	Watering apparatus.
	144 004.	Improved apparatus for watering gardens, roads, etc.
	143 752.	Improvements in watering appliances.
Spain	50 019.	Improvements in filtering presses.
Sweden	37 196.	Hothouse for forcing.
	37 233.	Device for attaching cattle in stables.
	37 332.	Filler.
	37 403.	Watering device.
Switzerland	67 371.	Automatic fodder distributor.
	67 372.	Apparatus for dry feeding, especially of pigs.
United Kingdom	13 790.	Implement for tapping rubber and similar trees.
	13 942.	Fostermothers for poultry.
	14 143.	Tobacco-stemming machine.
	14 222.	Apparatus for grinding and crushing corn and roots, and for separating leaves of hops.
	14 383	Sugarcane-mill roller.
	14 389.	Machine for removing pericarp from palmnuts and the like.
	14 413.	Weaning appliances for animals.
	15 091.	Machine for cleaning casks.
United States	1 110 951.	Windmill.
	1 111 583.	Traction belt for tractors.
	1 112 460, 1 113 493.	Tractors.
	1 114 424.	Elevator.
	1 114 112.	Portable elevator.

RURAL ECONOMICS.

97 – **Farms and Farm Property in the United States.** — *Thirteenth Census of the United States, Taken in the Year* 1910, Vol. V, *Agriculture*, pp. 1-320. Washington.

There were in the United States at the time the last census enumeration was made (April 15, 1910), 6 361 502 farms, containing 878 798 325 acres, of which 478 451 750 acres were improved, the remaining 400 436 575 acres comprising the acreage of woodland and other unimproved land.

The land in farms represented 46.2 per cent of the total land area of the country, the improved land only 25.1 per cent. The average size of a farm was 138.1 acres, of which on the average 75.2 acres were improved and 62.9 acres unimproved.

The total value of all farm property in 1910 reached the sum of $ 40 991 449 000, of which over two-thirds (69.5 per cent) represented the value of land, somewhat less than one-sixth (15.4 per cent) the value of buildings and about the same proportion (15.1 per cent) the value of the equipment. The total value of farm property a little more than doubled (100.5 %) during the decade 1900-1910. The greater part of this extraordinary increase was in the value of farm land, which increased no less than 118.1 per cent. This latter increase was largely due to the advance in the selling price of land, the average exchange value per acre being more than twice as high in 1910 as in 1900: $32.40 as compared with $15.57.

There were remarkable increases also in the value of farm buildings and equipment during the decade, the value of buildings having increased 77.8 per cent, that of implements and machinery 68.7 per cent, and that of live stock 60.1 per cent. These increases were due in part to higher prices of building materials, implements and farm animals, and do not represent correspondigly great additions to physical property. In spite of the decrease in the average size of farms, from 146.2 acres to 138.1 acres, the value of all farm property per farm increased from $ 3 563 in 1900 to $6 444 in 1910, or 80.9 per cent. The average value per farm of each class of property increased materially, but the largest increase was in the value of land, from $ 2 276 per farm in 1900, to $ 4476 in 1910. The average value of all farm property, per acre of land in farms, increased from $24.37 in 1900 to $46.64 in 1910; a gain of 91.4 per cent. The investment of farmers in buildings and equipment is chiefly utilized in connection with improved land. The average value of buildings per acre of improved land was $13.22 in 1910, as compared with 8.58 in 1900, while for equipment the corresponding averages were $12.94 and $8.23 respectively.

The average size of farms is less in the older sections of the country than in the newer, and in general less in the South than in the North. More specifically the average size of farms in 1910 was least in the East South Central division, being only 78.2 acres. It was 92.2 acres in the Middle Atlantic Division; 93.3 in the South Atlantic; 104.4 in New England; and 105 in the East North Central Division.

Among the individual States, the average size of farms was greatest in Nevada, Wyoming and Montana, where there are still many great cattle and sheep ranches. North and South Dakota ranked next to these three States. Most of the farms in these States were acquired under the homestead and other land laws and a large proportion of the settlers secured as much as 320 acres of land. A further contributing cause is the large number of great wheat farms in these two States.

In the South there are many plantations, some of very large acreage, which have been divided into small parcels of land of from 20 to 80 acres, each leased to a tenant. The operations of the tenants are often so completely supervised by the owner that the plantation is virtually a single

agricultural unit, but in the census statistics the land operated by each tenant is classed as a farm.

In the average value of all farm property, per acre of farm land, the geographic division which ranked highest, in 1910, was the East North Central, the average in that division being $85.81. The Middle Atlantic division was next, with $68.52; followed by the West North Central, with $58.18; the Pacific, with $54.18; and the New England with $43.99. In the Mountain division, as well as in each of the three southern divisions, the average value of farm property was between $20 and $30 per acre of farm land.

The average value of land itself, per acre, showed a wide range: from $61.32 in the East North Central division to $16.06 in the West South Central. The values were much lower in New England, the three southern divisions and the Mountain division, than in the other four divisions.

The several divisions differ much more widely in average value of buildings, per acre of land in farms, than in average value of land alone per acre, the amounts for the former item ranging in 1910 from $2.44 in the West South Central and Mountain to $22.70 in the Middle Atlantic division. The three north-eastern divisions (New England, Middle Atlantic and East North Central) reported a much higher value of buildings per acre of farm land than any of the others.

The average value of implements and machinery per acre of land in farms ranged in 1910 from $0.71 in the West South Central division, to $3.88 in the Middle Atlantic. Here, again, the three north-eastern divisions ranked very much higher than the others, in large part because of the high percentage of farm land improved and the more advanced and intensive methods used in the cultivation of the land, requiring a larger relative outlay for modern machinery.

Much less difference appears among the several divisions with respect to the average value of live stock per acre, the maximum being $8.28 for the East North Central division and the minimum $3.49 for the West South Central.

Among the various States, Illinois with $120.08 per acre, and Iowa with $110.40 per acre, reported the highest average value of all farm property per acre of farm land in 1910, while New Mexico reported the lowest, $14.15. These States ranked the same with respect to average value of land alone per acre, the amounts being $95.02, $82.58, and $8.77 respectively.

The southern divisions of the country, in general, showed greater percentages of increase, in the value of all farm property per acre of farm land, during the decade 1900-1910, than the northern divisions. The West South Central division outranked all others in this respect, with an increase of 147.2 per cent. The two most westerly divisions, the Pacific and Mountain, ranked second and third respectively, in percentages of increase, followed by the South Atlantic and the West North Central. In all five of the divisions just named the average value of all farm property per acre

of land was more than twice as high in 1910 as in 1900. The lowest rate of increase, 33 per cent, was in the Middle Atlantic division.

In the United States as a whole, and in most of the divisions, the relative increase during the decade in the average value of buildings implements and machinery, and live stock per acre of land in farms, was much less than the increase in the average value per acre of the land.

The country as a whole shows an increase, between 1900 and 1910 of 52.6 per cent in the average value of live stock per acre of land in farms The highest percentage of gain was in the South Atlantic division, 89.8 per cent, while the lowest was in the Mountain division, 24.1 per cent Among the States the highest rate of increase, 160.3 per cent, was shown in Arizona; and in three other States, Georgia and the two Carolinas, the value more than doubled during the decade. The only states showing a decline were New Mexico (37.5 per cent) and Colorado (1.7 per cent). The actual value of the live stock in both these States was much greater in 1910 than in 1900, but the acreage of farm land increased in still greater ratio.

In 1910 in the United States as a whole 62.1 per cent of the farms were operated by owners (including those renting additional land) and about 37 per cent by tenants, the proportion operated by hired managers being less than 1 per cent. The distribution of the acreage of farms was somewhat different. Farms operated by their owners contained 68.1 per cent of the total acreage in 1910, tenant farms only 25.8 per cent and farms operated by managers 6.1 per cent. Of the improved farm land, 64.8 per cent was in farms operated by their owners, 32.7 per cent in those operated by tenants and only 2.6 per cent in those operated by managers. Between 1900 and 1910 the number of farms operated by their owners increased 8.1 per cent, but the number operated by tenants increased twice as fast (16.3 per cent). There was a slight decrease in the number of farms operated by managers. Similarly the land in farms operated by their owners increased 7.6 per cent during the decade, while that in tenant farms increased 16.1 per cent. The land in farms operated by managers decreased greatly in amount. The improved land in farms operated by their owners increased 11.4 per cent during the decade while that in tenant farms increased 24.7 per cent, the absolute increase for the two classes being nearly the same. There was, moreover, an increase of 12.9 per cent in the acreage of improved land in farms operated by managers. The average improved acreage per farm in 1910 was 78.5 for farms operated by their owners, 66.4 for tenant farms and 211.9 for farms operated by managers. Between 1900 and 1910 there was an insignificant decrease in the average size of farms operated by their owners and by tenants, but a very great decrease in the average size of farms operated by managers. Of the total value of farm property in 1910 amounting to $40 991 449 000, the farms operated by their owners contributed $26 669 634 000 or 65.1 per cent; those operated by tenants $12 621 190 000 or 30.8 per cent; and those operated by managers $1 700 625 000.

During the decade the value of the property belonging to farms operated by their owners increased 93.9 per cent ; of that belonging to farms operated by managers 60.7 per cent; and of that belonging to tenant farms 124.2 per cent.

Prior to 1900 the census statistics did not distinguish farms operated by managers from those operated by their owners. The figures for the earlier censuses may, therefore, not be precisely comparable with those for later censuses, but they probably indicate the general tendencies with a sufficient degree of accuracy, namely the increase in the relative importance of farm tenancy.

Since 1880 and probably even earlier, farms operated by tenants have increased in number faster than those operated by their owners. Tenant farms constituted 25.6 per cent of all farms in 1880, 28.4 per cent in 1890, 35.3 per cent in 1900 and 37 per cent in 1910. During the 30 years from 1880 to 1910 the number of tenant farms increased by 1 330 075, or 129.8 per cent, while farms operated by their owners and by managers increased by 1 022 520 or 34.3 per cent.

The change indicated by these figures is what might be expected. In a new country, where land can be obtained cheaply, or even obtained from the Government without cost, it is but natural that most persons who wish to conduct agricultural operations become owners of land. As the country becomes more settled and as free land disappears and the values of land rise, it becomes increasingly difficult to acquire land, while, conversely, those who have already acquired it often find it possible to cease active labor and obtain an income by leasing their land to others, or prefer to enter some other occupation, but to retain their land as an investment.

The decided increase in the importance of farm tenancy in the United States has not been accompanied by any marked concentration of land ownership by a small number of individuals.

In 1900 more than a million of the owners of rented farms owned only one such farm, and 142 886 owned only two farms. Most of the persons who owned more than two tenant farms were the owners of southern plantations where the system of operation by tenants — chiefly colored tenants — has succeeded the system of operation by slave labor. The number of owners who had more than 20 tenant farms was only 3 244.

This investigation in 1900 revealed so clearly that there was no great degree of concentration in the ownership of rented farms and very little absentee landlordism in the United States that it was not considered necessary to make a similar investigation in the census of 1910.

98 – **An Estimate of the Capital Necessary for Starting a Farm in German South-West Africa.** — GAD, JOHANNES, in *Koloniale Monatsblätter*, Year 16, Part 5, pp. 243-248. Berlin, May 1914.

The writer has made statistical enquiries respecting the working conditions of 54 farms in Middle Hereroland (German South-West Africa) and gives in this article data concerning their conditions of capital, from

which he endeavours to determine the amount of capital necessary for the starting of a farm.

The average installation capital was as follows:

	£
In 1899	490
» 1900	833
» 1907	2 205
» 1908	3 010
» 1909	2 276
» 1910	2 744
» 1911	2 484
Average of all the years	2 508

Over 50 per cent of the farms investigated were in the 1st-3rd years of their development, and 25 per cent in the 4th year, so that since the starting of the farm no notable displacement of the distribution of capital had taken place. Only the live stock had increased on an average 100 per cent; this circumstance justified the writer in putting down only half of the average live stock actually existing, when calculating the initial capital outlay.

The capital represented by the farms was distributed on an average as follows:

	£
Land	113
Buildings	529
Water supply	309
Inventory	274
Live stock	833
Total	£ 2 058

Against the average investment of capital there accordingly remains, on an average, £440 which may be considered as expended upon the maintenance of the farm during the first unproductive years. For the soil, only the capital expended on it is entered. The capital in buildings seems rather high and perhaps exceeds the beginner's average requirements for farm buildings.

The expense of providing water varied on the 54 farms from £5 to £1372. The sum of £309 allotted for this purpose seems, for present conditions, rather too low than too high. The value of the dead stock does not appear excessive.

The value of the live stock, as estimated from the result of the enquiry, was on an average £1666; this does not represent the original sum expended, but the value of the animals at the time of the enquiry, when they had, on an average, increased 100 per cent; thus the original capital laid out on the purchase of stock must be estimated at about £833.

As well as meeting the necessary expenses of installation and stocking, the initial capital of the farmer must serve to keep the place going until it brings in some return, which will be at least two years.

The expenses of the food and wages of the native labourers amount in two years to £21 7*s*; thus if only ten men be allowed for, these come to £213 10*s*. At least £5 per month must be allowed for the farmer's own requirements, which represents £120 in two years.

If we take into consideration the risks due to the possible outbreak of cattle diseases, as well as the difficulties in finding a market, etc., a reserve capital of about £500 cannot be regarded as excessive.

The writer considers that he is not far wrong in stating that a farm in German South-West Africa cannot be started with a capital of less than £2500.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

99 – **Wines infected by Bitterness and their Treatment.** — GYULAY, KÁROLY, in *Boraszati Lapok*, Year 46, No. 45, p. 652. Budapest, November 8, 1914.

The new researches of WORTMANN on the "Bitterness" disease of wines have established, contrary to the observations of PASTEUR, that the bitter taste appears also in wines free from *Bacillus vini*. According to the former writer the germs causing this disease often enter the wine during the pressing of the infected grapes. According to PASTEUR the Bitterness disease is characteristic of red wines and in particular of Pinot wine.

The writer has found that white wines rich in tannin may also be infected. The most susceptible Hungarian wines are those from the Burgundy vines, especially those from a good vintage. Assuming that a high acidity prevents the development of the disease, the writer recommends an early vintage, or if this is not possible the racking should be carried out as early as possible and the wine should be blended with wines of high acidity. The writer also gives information relating to the manipulation of bitter wines. The physiological functions of the ferments causing bitterness in wines and their action are little known and require investigation by new researches.

100 – **The Enzymes of *Aspergillus oryzae* and the Application of its Amyloclastic Enzyme to the Fermentation Industry.** — TAKAMINE, JOKICHI, in *The Chemical News*, Vol. 110, No. 2866, pp. 215-218. London, October 1914.

Aspergillus oryzae plays an important rôle in the national economy of Japan, on account of the particular enzymes it generates during its growth. It is employed in the manufacture of 'sake' or rice beer, 'soy' (bean sauce) and 'miso'.

Cultures of this fungus on wheat bran are known as "Taka-koji" as distinct from rice cultures or "Koji". Taka-koji is designed as a substitute for malt as an amyloclastic agent in varied fermentation and allied industries.

Being made from bran it is free from the disadvantage of a fluctuating price as in the case of malt, the price of which varies according to the crop conditions of barley. Further, the transformation of bran into Taka-koji can be effected in 48 hours instead of the 6 or 8 days required for malt.

The process consists in first moistening and steaning the wheat bran, so as to sterilise the material and gelatinise the starch. It is cooled to a temperature of 40° C. and inoculated with the spores of the fungus. The culture may be incubated in thin layers on a cement floor or on trays provided with false bottoms of wire netting. The optimum temperature for growth is between 30° and 35° C. The necessary humidity is maintained by means of jets of steam. Rapid growth of the fungus begins after 16 to 18 hours, and in 8 to 10 hours it reaches a maximum which is indicated by a rise of temperature. Then a gradual decrease in temperature is noticed until the medium is saturated with the mycelium of the fungus within 48 hours of the time of inoculation. At this point vigorous and numerous conidiophores are already to be seen with yellow or greenish-yellow conidia spores. The diastatic strength of the mass it now at is maximum, and to prevent it from becoming infected with injurious bacteria it is dried in a current of dry air. With a moisture content of 10-15% it is immune from infection and can be kept for months. The process can also be carried out in a revolving drum with a great saving of labour, as in the case of the manufacture of malt.

Four per cent of the air- dried Taka-koji will give a complete conversion of well prepared mash material in 15 to 20 minutes. The fermentation is very rapid and complete, thus ensuring a minimum amount of infection.

Taka-diastase is obtained by precipitation from an aqueous extract by means of alcohol. It is a white or yellowish-white hygroscopic powder and is used in medicine in place of malt. It contains various enzymes, *viz* invertase, maltase, amylase, cytase, oxydase, peptase, ereptase, tryptase, lipase, chimosin, and an emulsin-like substance capable of converting helicin.

There is also unconfirmed evidence of the existence of an enzyme capable of converting starch to glucose directly.

Taka-diastase also possesses the property of resistance to acid and the diastatic action is accelerated to at least 10 to 15 % by the addition of mineral acid (sulphuric) to an amount of 1 part in 2000. Its activity also remains unchanged for years.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

101 – **Comparative Study of Milk, Based on Capillarity.** — LENK, EMIL, in *Die Naturwissenschaften*, Year 2, Part 33, pp. 813-816. Berlin, August 14, 1914.

According to Messrs. KREIDL and LENK, if a few drops of milk are let fall on thick blotting paper containing much ash, three concentric rings appear and successively spread. The outside ring gradually becomes less visible while the two inner ones are sharply distinguished from each other and remain visible for some hours. This is due, according to the writer, to a separation of the component parts of milk: fat, casein and water with the substances dissolved in it. The fat occupies the central area, casein the middle ring and the water with the salts the outer ring. The fat and the casein can be qualitatively recognized by suitable reactions. Milk that has been watered at the rate of 5:3 gives origin to a formation of concentric rings which begin to become less clear; a further dilution prevents the delimitation between the casein and the water rings from being recognized,

and the radial ratio between the two rings changes and becomes proportional to the quantity of water that has been added. Thus the content of casein and of water can be approximately determined on the basis of the more or less sharp delimitation of the two outer rings and on their ratio to each other.

The formation of the casein ring does not occur when the milk has been treated with an acid or with rennet, because the casein then takes the shape of granules. The same happens with milk containing a high percentage of fat (up to 30 per cent of fat), because the fat envelopes the casein granules and prevents their spreading. Human milk on the other hand forms only two rings, an inner area formed by the fat and an outer ring containing the other components of the milk. The casein ring is not formed because this substance is in solution and is not visible under the ultramicroscope. With the milk of mares, goats, rabbits and rats, which in their appearance under the ultramicroscope correspond to cow's milk, the formation of the three rings takes place. The milk of bitches and cats, while resembling cow's milk under the ultramicroscope, does not allow the formation of the three rings, owing to the high fat content, 9 per cent. The rapidity of diffusion of a drop of milk depends chiefly upon the amount of fat; it may therefore be used for the quantitative determination of the fat content. The rate of diffusion in connection with the fat content is as follows.

	Inch per minute
Milk containing 10 per cent of fat.	0.47
Whole milk	0.71
Watered at 50 per cent	1.22
Skimmed milk	2.36

The process of coagulation may also be followed by the concentric rings on blotting paper. On allowing drops of milk treated with rennet to fall at intervals on blotting paper, the casein ring grows smaller as the splitting up of the milk proceeds, and when coagulation is complete the formation of the casein ring ceases altogether.

KREIDL and LENK have also studied the behaviour of several kinds of milk, drawn from various mammals, as they ascend by capillarity in strips of filter paper.

They observed considerable differences in the height to which cow's milk and human milk attain, and in human milk according to the period of lactation. Human milk continues to ascend higher, up to the third month, after which it diminishes in height. These differences are due to the different concentration of casein, independently of the physical properties of this substance.

Watered milk rises higher than pure milk, but from the absolute level to which it rises no sure deduction can be made that the milk has been watered.

A skimmed milk rises slightly higher, but in this case also, the fat content cannot be inferred from the absolute level reached. The process of

curdling leads to a constant increase of level up to the moment in which all the casein has coagulated. After a prolonged action of the curdling agent the level sinks because the pores of the paper get obstructed with the increasing density of the coagulum.

The milk from various species of mammals reaches different levels, owing chiefly to the casein content ; the fat content affects results only when abundant, as in bitches' and cats' milk. The solutions of casein, of pancreatic juice and gall and of the blood of the horse rise according to the albumen content.

102 – **A Method for the Determination of the Fat in Milk (Nephelometric Method).** — BLOOR, W. R. (Washington University, St. Louis, Mo.) in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 6, pp. 1300-1304. Easton, Pa., June 1914.

The method is based on a new principle which has previously been employed in estimating fat in blood. It consists in determining the fat content by comparing the light-reflecting power of a suspension of milk fat in water with that of a similar standard suspension. One cc. of milk is run into 100 cc. of alcohol-ether mixture, heated and filtered ; 5 cc. of the filtrate are then added to 100 cc. of water, forming a colloidal solution, and 10 cc. of 10 per cent hydrochloric acid are used to flocculate the solution which is then transferred to the tube of the nephelometer to be tested against the standard solution.

The method is simple and rapid and would be specially useful where only a very small sample was available for analysis. Its results are accurate to within about 3 per cent.

103 – **The Technological Chemistry of the Manufacture of "Grana" Cheese in Reggio.** — FASCETTI, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. LXVIII, Part 8, pp. 541-568. Modena, 1914.

The bacteriological, chemical and technical studies made in Italy during the last ten years, on the manufacture of cheese, have concerned chiefly the types of great commercial importance and heavy production. In this work the "Grana" (Parmesan) cheese of Reggio and Lodi has occupied the first place, since, in Emilia as well as Lombardy, it has shown great technological difficulties and is consequently more susceptible to give rise to a certain quantity of defective products. The writer has been engaged on chemical, bacteriological and technical studies of cheese during the last eight years and in this article gives the results of his chemical studies.

He begins by summarising the ideas and hypotheses advanced up to the present on the means of manufacturing and ripening cheeses, and points out that the true technical study has been almost entirely neglected. He thus reviews : the investigations which attribute the ripening of cheeses to the action of organised ferments (COHN, MUSSO, DUCLAUX, FREUDENREICH, etc.) ; the investigations of the American school (BABCOCK, RUSSELL, HARDING, etc.), who attribute it to the action of chemical ferments ; the more recent investigations (ROGERS, JENSEN, BOEKHOUT and DE VRIES, VAN DAM, WEIGMANN, VAN SLYCHE and PUBLOW, HASTINGS, EVANS and HART), who take into account both series of phenomena and from which the writer concludes as follows :

Before working the fresh milk, enzymes are formed which peptonize casein as secretions from the different species of liquefying cocci of the udders. These enzymes prepare the nutritive elements for the activity of the lactic ferments, which, during the treatment of the milk in the warming vats, become predominant over all other enzymes. These cocci, as much for the enzymes appearing first as for those which arise independently until they grow with the lactic ferments, are able to exert an influence on the ripening of the cheese.

Once the milk is coagulated and the curd transformed into cheese by means of the rennet, compounds of paracasein with lactic acid and with calcium salts are formed until all the lactose is transformed. Under the action of the enzymes of rennet these new compounds of casein are broken up into albumoses and peptones with great rapidity and intensity. These new substances are subjected to dissociation by means of enzymes of a group of ferments not yet well known, which may even be the same lactic ferments or also peptonising ferments capable of producing the ultimate constituents of the dissociation of paracasein and albumoses and the lower amido-compounds and ammonia, and at the same time the special odours and flavours of each cheese.

Thus the harmonious relation between the quantity of rennet solution added to the milk and the degree and quality of the lactic fermentation which develops in it, produces the special chemical medium in which the different types of cheese are formed. A good technique is one which produces this special chemical condition and bacteriological equilibrium.

Variations in the acidity of the milk. — The writer has observed that the *natural* and *original* acidity of the milk on being drawn varies considerably (from 7 to 9.6 per cent) among cows under identical conditions. After 20 hours at 10° C., the acidity fell from 8 to 7.2 and from 9.6 to 9.0. This decrease is still further accentuated (an average of 0.9 per cent) by moderately warming the milk during several minutes immediately after drawing.

The addition of lactic acid to the milk raises the acidity in almost direct numerical relation to the quantity added, and there is nothing to prevent the same effect from the acidity due to fermentation. The writer defines the *acidity of fermentation* as the acidity due to the lactic fermentation and which is added to the natural acidity. The difference between the acidity of the milk and that of the serum after the coagulation of the casein is practically constant. This diminution is therefore due almost entirely to the removal of the casein.

Degree of Acidity of the fermentation in the manufacture of "Grana" cheese of Reggio.

The following determinations are the results of 9 experiments made by the writer:

Soxhlet acidity for 50 cc. of milk while being worked up	4.27
» » » » » serum	2.40
» » » » » » in the vat after cutting up the curd	2.92
« » » » » » at the end of scalding	3.15

If the natural acidity of the milk is deducted from the final acidity of the serum, there is a difference of 0.75 in the Soxhlet acidity, which is equivalent to about 35 grams of lactic acid per 100 litres of milk.

Chemical modifications of the coagulum under the action of the acidity of fermentation. — It is known that the acidity of the milk promotes the removal of the serum from the mesh of the coagulum. It reacts first with the insoluble phosphates, rendering them soluble ; then it decomposes the paracasein, forming calcium lactate and, if the acidity is very high, lactates of casein.

The writer has obtained experimental confirmation of the technical principle that the duration of manufacture of Grana cheese is in almost inverse relation to the degree of ripening of the milk. Thus, whilst a milk of Soxhlet acidity 3.8 coagulates in 30 minutes at 38° C. and the time of working the Parmesan obtained is 180 minutes, the same milk coagulates in 18 minutes when one adds (to the quantity necessary to give a cheese) 80 gms. of pure lactic acid, and the period of working is reduced to 60 minutes.

The addition of 1.5 cc. of normal lactic acid to 120 cc. of fresh milk and submitting it the process of making Parmesan at the same time that an equal sample to which no lactic acid has been added, showed that the lactic acid favoured a greater expulsion of the serum from the coagulum (which contained 48 per cent of water against 55.83) and removed from the coagulum about 2 per cent of mineral matter (5.3 against 7.23 per cent), represented by phosphate of lime, which passed into the serum as soluble phosphate and lactate of lime.

The serum contained in the coagulum before scalding increases the percentage of ash (1.91 per cent in the dry coagulum against 1.30 per cent in the same coagulum after washing) ; but at the end of scalding there is no sensible difference between the quantities of ash contained in the coagulum directly dried (2.43 per cent) and in the coagulum previously washed (2.41 per cent.); which proves that at the end of the scalding the granules of casein do not give up to the washing water the serum which they contain and form a homogeneous mass.

The addition to samples of 200 cc. each of the same milk of 10 cc. of distilled water or water containing respectively 1, 2 and 3 cc. of normal lactic acid before submitting them to the Parmesan process, shows that the soluble compounds of lime and phosphoric acid increase with the degree of acidity of the serum, but the compounds of lime in greater proportion than those of phosphoric acid, thus indicating that a part of the lime which passes in to solution in the serum belongs to a salt different from monocalcium phosphate, namely lactate of lime.

The plasticity acquired by the paracasein in proportion to its freedom from mineral constituents has been specially attributed to the presence of calciulm lactate. However this is not confirmed by the writer's experiments according to which the elasticity of the paracasein is certainly bound up with the presence of an acid salt, probably monocalcium phosphate.

Conclusions. — The correlation between the chemical modifications of the coagulum and those of the serum during the manufacture of Parmesan is indicated by the following figures:

Natural acidity of the serum of the milk before working	2.3–2.5
Acidity of the serum after cutting the curd	2.9–3.1
» » » » at the end of scalding	3.2–3.4
» » fermentation developed during the working, expressed as lactic acid	0.4–0.5
Coefficient of hydration of the casein granules at the end of working	58–60
Percentage of ash in dry matter	4.7–4.9

Comparing these figures with those furnished by ORLA JENSEN for Emmenthal cheese and the normal figures for Cheddar as given by the Dairy Institute, Reading, it is apparent that Emmenthal cheese is made under conditions of very low acidity of fermentation, whilst Grana cheese requires a certain amount of acidity and Cheddar requires a much greater acidity. After manufacture, the casein granules should therefore possess very different chemical composition and physical properties, which differences appear in the cheese and in the quality and intensity of the fermentations taking place within it.

104 – **Milk Production in Norway.** — SEBELIEN, JOHN, in *Chemiker Zeitung*, Year 38, No. 126-127, pp. 1144-1145. Cöthen, October 22, 1914.

According to the returns of the agricultural section of the Norwegian Jubilee Exhibition, which took place this year in Christiania, the total annual milk production was:

	Gallons
In 1815	41 800 000
» 1855	127 900 000
» 1900	193 600 000
» 1910	256 200 000

The price of milk rose from 3.47 *d* per gallon in 1815 to 6.41 *d* in 1910. The fat content, as proved by 200 000 tested samples, has increased since 1895, on the average, from 3.45 per cent. to 3.60 per cent.

The development of the production is shown by the following table:

	Millions of pounds		
	1880	1900	1910
Butter	0.946	7.876	8.157
Skimmed milk cheese	0.986	2.950	6.676
Whey cheese (Mys-ost) (1)	1.526	3.775	6.558
Fat cheese	0.585	2.763	3.898

(1) Cheese made both from cows' and goats' milk and for the most part from whey concentrated by evaporation, with the addition of milk or buttermilk. (*Ed.*).

The exportation of butter began in 1871-1875, and now amounts to 3.3 million lbs. The other 5 to 5 ½ million lbs. are partly directly consumed in the country and partly used in the factory for native margarine. The butter export reached its highest in 1881, when it amounted to 7.7 million lbs.; now, however, it has decreased to 1 540 000 lbs.

Cheese began to be exported at the commencement of the seventies and now nearly 550 000 lbs. are annually exported. More cheese, is, however, imported, especially the finer qualities, the annual imports amounting to 660 000 lbs.

The manufacture of condensed milk in the factories is of greater technical importance. This industry dates from the seventies in Norway and now 33 000 000 lbs. of condensed milk are made every year, of which 29 700 000 lbs. are sweetened, and the rest unsweetened. The total amount of milk used annually in the condensed and preserved milk factories is 88 000 000 lbs. and the export value of these products is about £550 000.

Of late years, dried milk factories have also been established in Norway.

105 – **The Dairy Industry in Italian Africa.** — Pucci, Carlo, in *L'Italia Agricola Giornale di Agricoltura*, Year 51, No. 11, pp. 481-484. Piacenza, November 15, 1914.

In Italian Africa (Libyia, Eritrea, Somaliland) the dairy industry is still carried on by primitive methods and apparatus. Generally, the yield of milk is obtained at the expense of everything else, not leaving enough for the offspring which are consequently in a wretched physiological condition rendering the improvement of the live stock impossible. In Libya dairy products are made from the milk of cows, sheep and goats, whilst the camels milk is generally consumed as such. Goats are kept specially for milk production. Butter making provides a certain amount for export, a mixture of goat's milk, and sheep's milk being used for the purpose. Butter is also made from cow's milk but it is less profitable, realising about 1*s* 4*d* to 1*s* 6*d* per lb against 1*s* 6*d* to 1*s* 7*d* per lb. for the former product. The centres of the butter market are Alexandria, Smyrna, Crete, etc. Buttermilk is used as a beverage. A small quantity of cheese for immediate consumption is also produced.

In Abyssinian native markets butter sells at about 1*s* 2*d* per quart in Somaliland at about 25*s* per tin of 18 quarts. It is also exported to the markets of Zanzibar and Arabia.

Exports of butter from Italian Somaliland, 1908-1912.

Year	Weight	Value
	lbs.	£
1908–1909	373 080	9 660
1909–1910	170 543	4 112
1910–1911	161 354	4 492
1911–1912	143 790	4 284

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

106 - **Legislation concerning Diseases and Pests of Plants in Mauritius.** — *Department of Agriculture, Mauritius, General Series, Bulletin* No. 2, 10 pp. Port Louis, Mauritius, 1914.

Legislation against plant diseases and pests in Mauritius dates from 1882 with the adoption of "Ordinance No. 14" which controlled the importation of vines, as plants or cuttings. An "Amending Ordinance of the Customs, 1892," was approved in 1905 and was designed to prevent the introduction of injurious animals, birds or reptiles.

Conforming to this Ordinance, a proclamation was issued in 1913 to prevent the importation of any live insect. In 1910 a second Ordinance was passed preventing the introduction into the Colony of plant diseases and pests. The control of the spread of diseases and pests of trees and other plants is effected by Ordinances No. 8 of 1913 and No. 9 of 1912.

The general application of the various provisions is entrusted to the Department of Agriculture and the carrying out of the work is the chief duty of the two divisions of Phytopathology and Entomology.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

107 - **Correlation between the Mortality of *Ailanthus glandulosa* and the Disappearance of *Attacus cynthia*, in France.** — KÜNCKEL D'HERCULAIS, J., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 2nd Half-year, Vol. 159, No. 2, pp. 210-212. Paris, 1914.

Ailanthus glandulosa was introduced into Europe in 1751 to be used as in China for outdoor rearing of a silk-producing Bombycid (*Attacus cynthia*). This moth escaped in the adult stage from open-air colonies in the Bois de Boulogne and at Vincennes, and had lived at liberty for 50 years (since 1864). Both the tree and the insect were considered naturalised.

At present, however, on the right bank of the river Seine, from Conflans Sainte-Honorine to its confluence with the Oise, old and young specimens of *A. glandulosa* may be seen dead and the surviving trees with dead branches. Several years ago gall-like or tubercular excrescences were noticed on the roots of an *Ailanthus*. This phenomenon had also been observed in France in 1910 and also in Bavaria in 1894 and was attributed to natural growth of non-parasitic origin.

The writer had also noticed that the larvae of *A. cynthia* feeding on the leaves of the dying *Ailanthus* were diseased and that instead of solid faeces they excreted liquid matter and died soon after. No more cocoons of *A. cynthia* have since been seen hanging from the branches of the *Ailanthus* trees, nor have any moths appeared. The disease of the larvae is attributed to their feeding on the leaves of decaying trees, which are deficient in food materials.

108 - **Researches on the Biology and Pathology of Olive Flowers** (1). — PETRI, L., in *Memorie della R. Stazione di Patologia Vegetale, Roma*, V, pp. 5-64, figs. 1-5, 1 plate. Rome, 1914.

Almost all olives, wild or cultivated, in either good or bad conditions of growth, are liable to a more or less early arrest of the development of the ovule. Of the external conditions which favour the almost complete sterility of olives by abortion of the ovary, the most important is prolonged drought. The same effect is also produced by defoliation and any other cause which leads to an insufficient movement of water in the plant tissues.

On the same plant and even on the same flowering shoot of the most fertile specimens, it is possible to find flowers with ovaries showing aborted development at different stages. The percentage of flowers with aborted ovaries is subject to periodic fluctuations, of which the duration depends upon the vegetative conditions.

The arrest of development of the ovary is primarily due to an insufficient supply of nitrogenous matter, which appears to be connected as much with an insufficient absorption of nitrates as with a diminution of the nitrogen metabolism of the leaves. Vegetative division, though not a cause, is a means, of preserving this abnormality, and it is recommended that in the selection of scions for grafting, those plants which continually show a high percentage of flowers with aborted ovules should be rejected. According to our present knowledge the constancy of abortion in certain trees may be attributed to a change, difficult to correct, in certain physiological functions of the flowering shoots, under the more or less prolonged influence of exceptional conditions of nutrition due to the direct action of the medium or to the indirect action of important changes of the absorptive and vascular function of the rootlets.

Female flowers with aborted anthers are not developed on olives, and nothing has yet been obtained to prove that the almost sterile trees with aborted ovaries are useful as pollinisers. Autogamy is a normal occurrence.

(1) See also *B.* July 1913, No. 876. (*Ed.*).

The differentiation of the apical meristem of the lateral shoots into flower-buds may take place under the influence of exterior agents and there is no reason to suppose that the character of bearing terminal inflorescences is fixed. The results of the researches on the floral biology of the olive do not affect the ordinary methods of cultivation in use, but attention should be paid to the choice of the proper methods of remedying the persistant sterility of numerous groves.

From remote times some growers have practised the gradual replacement of the head of the tree by means of scions taken from trees of high fertility; others have endeavoured to restore the fertility of the sterile trees by means of manuring and pruning. These methods, however, have been applied too empirically and on too small a number of trees to give conclusions of real value to the scientist and practical man.

109 – **The Toxic Action of Sulphur Dioxide on Olive Flowers** (1). — PETRI, L., in *Memorie della R. Stazione di Patologia vegetale, Roma*, VI, pp. 65-76, 1 fig. Rome, 1914.

As the result of preliminary experiments on the toxic action of sulphur dioxide on the flowers of the olive, it was found that a concentration of 1 in 16000 parts is directly injurious to the stigmas when the relative humidity of the air reaches 75-80 per cent. Those stigmas whose functional activity is very much reduced, and whose papillary surface is consequently only slight mucilaginous, are less affected by the gas. The pollen is much more resistant. The sepals and petals are as resistant as the young leaves or only slightly less so.

These researches show that it is possible that direct damage to the stigma is produced by sulphur dioxide without the plants showing the ordinary effects of the gas on the leaves, calyx or corolla. The single evidence of the diminished yield of olives supposed to be damaged by sulphur dioxide does not provide any explanation of the subsequent effects of this gas. In this case the determination of the condition of the ovary at flowering-time in flowers supposed to be damaged by sulphur dioxide and in normal flowers, indicates with sufficient accuracy how much of the sterility is to be attributed to the effects of chronic poisoning or other causes, and how much to the acute effects of the gas. In this way it is possible to make an exact estimation of the damage.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

110 – ***Sphaerotheca pannosa* and its Conidial Form (*Oidium leucoconium*): Morphological and Biological Differences according to its Hosts.** — WORONICHINE, N., in *Bulletin trimestriel de la Société mycologique de France*, Vol. XXX, Part 3, pp. 391-401, plate XXIV. Paris, 1914. FUNGI

With a view to deciding the question of the identity or not of the conial stage (*Oidium leucoconium* Desm.) and the perithecial stage (*Sphaero-*

(1) See also *B.* April 1912, Nos. 726-729; *B.* Nov. 1913, No. 1296. (*Ed.*)

theca pannosa [Wallr.] Lév.) of the fungus producing rose mildew, which also occurs on peach and almond, abundant material for study was collected near Sotschi (government of the Black Sea, Caucasus) during the summer of 1913. Numerous herbarium specimens of various origin were also examined.

Two lines of experimentation were suggested: inoculation of roses with *O. leucoconium* taken from peaches and inoculation of peaches with the form occurring on roses. Since no healthy roses were available, the experiments were limited to the inoculation of peaches with *Oidium* from roses. The results of these experiments showed that the conidial form from the rose was not able to attack the leaves of peaches.

A comparative examination of herbarium specimens with regard to the perithecial stage (*S. pannosa*) has shown that the parasite living on peach and almond differs from that found on rose in having smaller perithecia, asci and ascospores. Further, with regard to the conidial forms (*O. leucoconium*), herbarium specimens show that the conidia from peach leaves, though very much resembling the conidia of the *Oidium* of the rose always show slightly smaller average dimensions than the latter. No differences in the structure of the conidiophores of the *Oidium* on rose and peach have been found. The vegetative mycelia are evidently identical though the vertical sterile hyphae differ slightly in dimensions, while in general the hyphae on rose are somewhat longer and wider than those on peach and almond.

Considering these morphological and biological differences it is proposed to distinguish the two fungi as varieties: *S. pannosa* var. *rosae* and *S. pannosa* var. *persicae* respectively.

DISEASES OF VARIOUS CROPS

111 – **_Colletotrichum chamaeropis_ on the Leaves of _Chamaerops excelsa_.** — GABOTTO, L., in *Bullettino della Società botanica italiana*, No. 7-8, pp. 103-104. Florence, 1914.

The leaves of *Chamaerops excelsa* in a garden at Casale Monferrato (Piedmont) have been found to be attacked by a disease which is characterised by a shrivelling at the base and the gradual destruction of the leaf tissue, thus destroying the ornamental value of the plant. The decayed tissue of the upper surface of the leaf is found to contain large numbers of acervuli of a *Colletotrichum*, described by T. Ferraris and the writer as a new species under the name of *C. chamaeropis*.

112 – **Dying-back of Fig Trees in the Sorrento Peninsula, Italy.** — SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura in Acireale, Bollettino* No. 16, pp. 1-3. Acireale, 1914.

This disease was observed for the first time in 1913 in the Sorrento peninsula. It is characterised by a wilting of the branches and by scorched spots on the leaves: the former eventually dry up, while the latter become detached and fall; the disease develops rapidly and is not preceded by chlorosis. It occurs in two phases: the first in spring, when it causes rapid withering of the young branches, which appear scorched; the other in autumn, when it develops slowly and attacks the leaves more than the branches; fruits on the affected branches wither up.

The fruits on diseased trees do not attain complete maturity and are less sweet and more delicate, so that they readily get bruised and blacken on drying.

It has not yet been possible to determine if the disease is one which was formerly of rare occurrence in the peninsula and has now increased, or if it has been introduced. According to some, it has only appeared during recent years. At present it does not appear to be very widespread, but it may easily become so, since the writer's experiments have demonstrated that it is of bacterial origin. It has not yet been possible to determine if this disease is identical with that studied by Comes (gummosis of figs) and later by Cavara and Petri (bacteriosis of figs).

The disease begins at the tips of the new spring shoots, and after destroying them enters the branches on which they are borne. Possibly inoculation is effected by some insect, as in the case of the bacterial " pear blight " (1) in America. The disease spreads only slowly from the leaves to the twigs through the petioles ; but thence it goes on from branch to branch within the tissues of the tree until after a certain number of years the whole tree dies from exhaustion.

Results of trials on control begun in September 1913 show that cutting-out of affected twigs and branches effects a considerable reduction in the disease ; this pruning is best done during the growing season, and preferably in both spring and autumn ; in winter it is not so easy to recognise the diseased branches. Leaves showing the scorched spots should also be removed.

113 – ***Peridermium cedri*** **injurious to Deodars (*Cedrus deodara*) in India.** — TROUP, R. S., in *The Indian Forester*, Vol. XL, No. 10, pp. 469-472, plate 14. Allahabad, 1914.

In 1912 the writer observed that *Peridermium cedri* Barclay, the fungus causing " witches' brooms " on deodars, which was supposed to be harmless but was little known and rarely recognised, was not so harmless as generally believed. The observation was based on one or two cases in the Jaunsar, where the damage caused by this fungus was not altogether insignificant. Further observations made during a recent tour in the Himalayas of the Punjab convinced the writer that the fungus is more widely spread and more serious than previously supposed.

The most badly affected locality noted is situated in the valley of the Beas, at Monali, district of Kulu. In the pure deodar plantations established in 1875 and covering an area of about 189 acres, large numbers of trees died over a series of years. This mortality was generally attributed to fungus attack, though the presence of a fungus had not been proved, and also for a time to bad drainage. The writer visited these plantations in May 1914 and succeeded in finding that *P. cedri* was the cause of the damage.

The diseased trees have a characteristic appearance as follows: the foliage begins to thin out below the leader, and the twigs and branches die ;

(1) See *B.* Oct. 1914, No. 952. (*Ed.*).

the leader survives for a time but eventually succumbs. The disease may spread and destroy the whole tree. If a diseased tree is felled and examined about May, the new leaves are found to be curled and covered with yellow spots containing the fructifications of the fungus.

The plantations at Monali are situated on level ground in a rather damp valley about 6000 feet, under conditions undoubtedly favourable to the spread of the parasite. Many of the wild trees in the neighbourhood are seriously damaged and the disease occurs in the natural forests on the hill slopes above the valley. Hundreds of diseased trees have already been cut down; many others are dying and 80 per cent of those surviving are already visibly infected.

When once the disease is well established in a plantation it is practically impossible to deal with it. Cutting down the diseased trees checks it to some extent, but it spreads very readily, and unless it is detected before it gets a hold, there is little chance of exterminating it. The cutting out and destruction by burning of the diseased parts on the first appearance of the disease is easy to carry out, since it is not difficult to recognise the disease. The most suitable time for the cutting is in May, when the diseased leaves are visible. As a means of prevention against the spread of the disease, plantations should not be established in wet valleys, and other suitable species should be planted with the deodars.

With regard to the distribution of the fungus, the writer has found it in all the deodar zones that he has visited, namely: Jaunsar (fairly widespread), Kulu (very widespread in the valley as well as on the hillsides), Bashahr, Nogli Range (rather widespread), Simla Hills (several cases along the Simla-Narkanda road).

It would be interesting to know if the fungus occurs also in the dry zones planted with deodars, as in the Upper Sutlej Valley, and also in Chambra, Hazara and Kashmir.

114 – ***Trentepohlia annulata*, an Alga living on the Roots and Stumps of Conifers in Moravia, Austria.** — PRÁT, SILVESTR, in *Österreichische botanische Zeitschrift*, Year LXIV, No. 9-10, pp. 420-421. Vienna, 1914.

The article gives a morphological description of *Trentepohlia annulata* Brand (Chlorophyceae), found in 1912 on the roots of conifers near Trebitsch, and also in the beginning of September 1913 on a stump in the same neighbourhood.

This alga appears to find the most suitable conditions for development on stumps, though it also occurs frequently on the roots.

WEEDS AND PARASITIC FLOWERING PLANTS.

15 – **The Germinating Power of the Seeds of *Cuscuta trifolii* in Farmyard Manure, Liquid Manure and Soil** (1). — MORETTINI, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVII, Part 9-10, pp. 733-751. Modena, 1914.

Experiments during 1911 to 1913 have shown that the seeds of *Cuscuta trifolii* lose their germinating power to a considerable extent after immersion in liquid manure or pure water for a month. When they are buried in soil to a depth of 6 to 8 inches, the germinating power improves during the first months, but after three months it diminishes much more rapidly than in the case of seeds stored in a dry place.

In well made manure the seeds mostly lose their germinating power after the first month, even when only slightly buried in the heap; in certain cases, however, a small percentage retain their vitality. Well made farmyard manure is therefore not considered to be a ready means of spreading this and other species of dodder, as has been believed, though it must not be excluded as a means of infection.

16 – **Mixtures for the Destruction of Weeds.** — CRIVELLI, E., in *L'Industria chimica, mineraria e metallurgica*, Year I, No. 15, pp. 410-411 (409-413). Turin, November 10, 1914.

In treating of the so-called plant poisons, the writer deals with the various methods for the destruction of weeds.

Many American farmers use a 5 per cent solution of copper sulphate or a 15 per cent solution of ferrous sulphate to destroy weeds growing with cereals ; a single spraying destroys most of the weeds in a few days, without any damage to the crop.

In tropical countries, where the luxuriant growth renders the upkeep of railways particularly costly, resort is had to arsenical mixtures to keep the tracks free from weeds. A liquid of this type used by a South American Railway Company consists of : white arsenic 72 gms., caustic soda 15.5 gms., phenolphthalein sufficient to give an intense coloration, water to make up to 100 cc. This solution diluted 1 in 10 is sprayed over the whole width of the track by means of special trucks attached to the end of goods trains, at the rate of about 1 quart per square yard. During the first year it is repeated every three months, then every six months. The Columbia and Ecuador Railways have adopted a liquid composed of equal volumes of a 17 per cent solution of nitrate of soda and a 20 per cent solution of arsenious acid.

In Europe this treatment is only required on roads paved with cobbles and on walks in gardens and parks. The writer has experimented in such places with sodium sulphide ; though dearer, this is more practicable near habitations. Sodium sulphide has also been suggested for the sterilisation of soil before sowing. This method was then adopted in the United States, using the cheaper barium or calcium sulphide in place of the sodium sul-

(1) See also *B.* Jan. 1914, No. 81. (*Ed.*).

phide. Considerable quantities of the sulphides of the alkaline earths are in common use in the United States for destroying noxious weeds in the soil.

In a recent patent by L. Cheeseman (U. S. A., No. 1076 818, Oct. 20, 1913), the sterilisation of the soil is effected by means of a mixture of barium sulphide and quicklime. A patent by Bellanger (France, No. 433 159, Aug. 10, Oct. 26, Dec. 17, 1911) comprises a mixture of barium sulphide (25 parts), barium aluminate (50 parts), barium chloride (25 parts). Another patent (U. S. A., No. 1070 808, Aug. 19, 1913) proposes the treatment of the furrow slices with a mixture of anthracene oil and humus.

A fertilising and fungicidal powder patented by Fontaine (France, No. 433 127, Nov. 21, 1910, Nov. 4, 1911, Jan. 15, 1912) has the following composition: flowers of sulphur 6 parts, potassium chloride 5, superphosphate 5, quicklime 55, sulphate of iron 20, water sufficient to slake the lime. Another mixture with the same object was patented by Dokkenwaden (France, No. 389 729, April 29, July 7, Sept. 10, 1908) and consisted of 452 lbs. of saturated solution of sodium nitrate, 22 lbs. of potassium chloride with 72 tons of absorbant matter (wood pulp, etc.) or else 880 lbs. of superphosphate with 116 tons of marl, the whole mixed with raw petroleum or phenol at the rate of 44 lbs. per ton. There is also a powder devised by Matheron (France, No. 336 117, Oct. 29, 1903, Feb. 29, 1904) for the destruction of weeds, consisting of a mixture of copper sulphate and ferric chloride, with a salt of salicylic acid ; it is used in solution of 20 to 30 lbs. per 100 gallons, at the rate of about 90 gallons per acre.

117 – **Observations on the Use of Kainit in the Destruction of Weeds.** — VASTERS, J. (Experiments and assistance by REMY, TH. — Communication of the Royal Agricultural Academy of Bonn-Poppelsdorf, Institute of Agriculture and Cop Production), in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 4, pp. 627-657, figs. 14-17. Berlin, 1914.

The first experiments to test the value of potash manures in the destruction of weeds were carried out ten years ago. The results were very contradictory and generally compared unfavourably with those obtained with sulphate of iron. However, these experiments are worthy of repetition, owing to the greater cost of sulphate of iron and to its injurious action, whilst potash manures have a beneficial secondary effect. The present researches carried out in three series in the Rhine province and the comments on the observations of other workers establish the conditions under which weeds can be destroyed by means of kainit.

The conclusions arrived at are as follows :

1. It is most important to apply it in sufficient quantities. The minimum application is 10 or 11 cwt. per acre, and it should be increased in proportion to the growth of the weeds up to a maximum of about 16 cwt. per acre. If success is obtained with smaller quantities it is probably due to particularly favourable conditions.

2. Success can only be obtained when the kainit is spread on plants very wet with dew or rain, and its application should be followed by a fine day, but not by drought. Misty weather prolongs the period necessary for the destruction of the weeds, but does not interfere with the final success of the treatment

3. The effect of the kainit is more intense if the soil is dry or frozen, since its plasmolytic action is increased by the absorption of water from the soil. This treatment should, however, not be applied to winter cereals during frost or when the soil is frozen to any depth, as the crop may be damaged as well as the weeds.

4. The effect of the kainit is increased by grinding finely and by uniform distribution.

5. The weeds should not be too large, as the effect is greater the earlier the kainit is applied.

6. Kainit does not destroy all weeds. Complete observations are not yet available, but the following conclusions can be made :

a) Weeds very sensitive to kainit are: charlock (*Brassica arvensis*), runch (*Raphanus raphanistrum*), black bindweed (*Polygonum convolvulus*), *Anthemis arvensis*, *Veronica agrestis*, chickweed (*Stellaria media*), nettle (*Urtica* sp.), groundsel (*Senecio vulgaris*), cornflower (*Centurea cyanus*).

b) Moderately susceptible: *Arabis perfoliata*, redshank (*Polygonum persicaria*), spurrey (*Spergula arvensis*).

c) Slightly susceptible: *Atriplex hortensis*, sowthistle (*Sonchus* sp.), fumitory (*Fumaria officinalis*).

The species in the different groups are placed as nearly as possible in the order of their susceptibility to kainit.

7. Top-dressing with kainit has a temporary clogging effect on the surface layer of heavy soils, but this effect soon disappears when the soil receives a sufficient dressing of lime. In this case the unfavourable physical effects of the kainit on the soil are of little practical significance.

8. There is little doubt that the potash in the kainit exerts its full effect when applied as a top-dressing. If it is not directly available to the existing crop it will be of value to the succeeding crop or go to enrich the soil in potash.

9. It appears that kainit of carnallitic origin is preferable to that from sylvine.

10. Our cereals mostly stand top-dressings of kainit very well. Barley appears to be most susceptible, but even in this case the damage produced by a dressing of 1 ton per acre is only transient. In these experiments no permanent damage due to kainit was recorded. More often the final effect was obviously favourable when the manure had done its work as a weed killer. Pulse crops appear to be generally susceptible to top-dressings of kainit. With root crops kainit is not used, as the weeds are dealt with by hoeing.

11. The expenses incurred in using kainit as a weed-killer are relatively insignificant. They include the increase due to finer grinding, which is 2 ½ *d* per cwt., and the cost of distribution, which amounts to 3*s* per acre for a dressing of about 11 cwt. Other expenses are not included, since the potash takes the place of fertiliser and the cost of distributing is saved for another season. The application of potash in quantities necessary for the destruction of weeds exceeds by 135 to 225 lbs. per acre the annual

requirements of the crops, but this cannot be regarded as bad economy since the excess of potash enriches the soil to the advantage of all other crops.

12. Naturally kainit cannot be compared with hoeing in its effects on weeds. Hoeing has an influence on the soil texture, so that it cannot be replaced by either spreading or spraying treatments, which should only be used when the hoeing of cereals is absolutely impossible.

13. Other manure salts may also be used as weed killers, but kainit combines in a special manner the necessary properties for the destruction of weeds as follows : *a*) unlike 40 per cent potash salts and nitrate of soda, kainit has no permanent injurious effects in large quantities ; the temporary excess of potash is available for the succeeding crop, or goes to increase the capital of potash in the soil ; *b*) the principal constituents of kainit are readily soluble, and, except in the case of magnesium chloride, their low molecular weight increases their plasmolytic effect ; *c*) under normal conditions the hygroscopicity of the kainit is sufficient to effect its solution, but does not interfere with its being reduced to powder or with the keeping-properties of the powdered salt ; *d*) in applying the necessary quantities the poisonous effects of the secondary constituents of kainit are not strong enough to cause permanent damage to cereals.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

118 – **Orthoptera of Setubal, Portugal.** — CORDEIRO, V. A., in *Broteria, Serie Zoologica*, Vol. XII, Part III, pp. 209-214. Braga, 1914.

The following are included among the 48 species enumerated by the writer : *Forficula auricularia* L. (" bichas-cadellas ", abundant); *Phyllodromia germanica* L. (abundant); *Stenobothrus bicolor* Charp. and *S. pulvinatus* Fisch.; *Pachytilus danicus* L. (common); *Oedipoda coerulescens* L. (common); *Acridium aegyptium* L. (very frequent); *Caloptenus italicus* L. (very frequent); *Phaneroptera quadripunctata* Brunn. (on vine); *Locusta viridissima* L.; *Decticus albifrons* Fabr.; *Oecanthus pellucens* Scop.; *Gryllus campestris* L. and *G. bimaculatus* De G.; *Gryllotalpa vulgaris* Latr. (known commonly as " ralo ", very frequent and injurious) (1).

119 – **Aphides of Portugal** (2). — TAVARES, J. S., in *Broteria, Serie Zoologica*, Vol. XII, Part III, pp. 177-193, figs. 1-8. Braga, 1914.

Following his own and previous work, the writer catalogues 89 species of aphis, commonly known in Portugal under the name of " piolhos das plantas " and " pulgões ". The majority of them give rise to galls on crops or other useful plants.

(1) See also *B.* Oct. 1914, No. 971. (*Ed.*)

(2) See also *B.* March 1912, No. 586 ; *B.* Jan. 1913, p. 3. (*Ed.*).

120 – **The Lepidoptera of Serra de Gerez, Portugal.** — MENDES, CATULLO, in *Broteria, Serie Zoologica*, Vol. XII, Part III, pp. 204-208. Braga, 1914.

In this list of 73 species, the following are more or less injurious: *Pieris rapae* L. (common and abundant) ; *P. napi* L. (abundant) ; *Leptidia sinapis* L. (very abundant) ; *Limenitis camilla* Schiff. ; *Pyrameis cardui* L. (1) ; *Polygonia C-album* L. ; *Callophrys rubi* L. (common) ; *Lymantria monacha* L. (a single specimen) ; *L. dispar* L. ; *Lasiocampa quercus* L. (one female) ; *L. trifolii* Esp. ; *Macrothylacia rubi* L. (abundant) ; *Abraxas grossulariata* L.

121 – **Relation of Variation in the Number of Larval Stages to Sex Development in the Gipsy Moth *(Porthetria dispar)*.** — MOSHER, F. H., and WEBBER, R. T., in *Journal of Economic Entomology*, Vol. 7, No. 5, pp. 368-373. Concord, N. H., October 1914.

In the course of experiments on the feeding of larvae of *Porthetria dispar* on various plants, carried out at the Gipsy Moth Laboratory (Melrose Highlands, Mass.), it was found that all larvae which pupated in the fifth stage produced male moths, while those having a sixth stage developed females. As the head is distinctly larger in the sixth than in the fifth stage, it is possible to control the question on pupae in the open in those cases in which the larval skin with head attached remains in the silk of the cocoon : examination of a number of such pupae in Massachusetts and New Hampshire gave no exceptions to the Laboratory observation.

A similar difference in number of stages according to sex had been recorded by various observers for several species of the genus *Orgyia*.

The writers point out that the gipsy moth has modified some of its habits since the early years of its naturalisation in the United States : it now rarely lays its eggs on *Berberis* sp., which used to be a favorite plant ; it is far more susceptible to disease than formerly ; the average number of eggs laid by a female is smaller (except in newly infested territory), and full-grown larvae are rarely as large as those recorded sixteen or seventeen years ago. It may be that the number of moults has also changed, as Prof. FERNALD reported in 1896 a variation from 4 to 6 for females and from 4 to 5 for males.

122 – **New Genera and Species of Entomophagous Fungi.** — THAXTER, ROLAND, in *The Botanical Gazette*, Vol. VIII, No. 3, pp. 235-253, plates XVI-XIX. Chicago, Illinois, 1914.

MEANS OF PREVENTION AND CONTROL

The following new genera and species of entomophagous fungi are described : 1) *Hormiscium myrmecophilum* sp. nov., on various parts of the body of *Pseudomyrmex* sp. in the basin of the Amazon ; 2) *Muiogone chromopteri* gen. et sp. nov., on the under side of the abdomen of *Chromopterus delicatulum* Beck., in Kamerun ; 3) *Muiaria gracilis* gen. et sp. nov., on the feet and under side of the abdomen of *Leucophenga* sp., in Kamerun ; 4) *M. lonchaeana* sp. nov., on the abdomen, feet and antennae of *Lonchaea* sp. in Kamerun ; 5) *M. armata* sp. nov. on the legs of *Drosophila* sp., in Sarawak, Borneo ; 6) *M. repens*, on the wings and abdomen of *Clasiopa* sp., in Kamerun ; 7) *Chantransiopsis decumbens* gen. et sp. nov. on the un-

(1) See also *B.* Oct. 1913, No. 1224 ; *B.* Nov. 1913, No. 1308. (*Ed.*).

der side of an undetermined Staphylinid at Malang, Java ; 8) *C. stipatus* sp. nov., on the lower side of a Staphylinid allied to *Tachinus*, in Java ; 9) *C. xantholini* sp. nov., on the lower side of the thorax of *Xantholinus obsidianus*, at Cambridge, Mass. ; 10) *Amphoromorpha entomophila* gen. et sp. nov., on the bristles of *Diochus conicollis* Motsch., on species of two other genera of Staphylinidae and also on a species of *Labia* (?), at Manila, P. I.

123 – **Life-History and Ecology of *Tiphia inornata*, Parasitic on *Lachnosterna* spp.** — WOLCOTT, GEORGE N. (Traveling Entomologist, Porto-Rico Board of Agriculture), in *Journal of Economic Entomology*, Vol. 7, No. 5, pp. 382-389. Concord, N. H., October 1914.

The writer was engaged in Illinois from September 1912 to November 1913 in the collection of cocoons of *Tiphia inornata* Say (Hymenoptera, Scoliidae) to send to Porto Rico, where it is hoped to establish the species to aid in the control of *Lachnosterna* grubs (1), which are a serious pest of sugarcane and other crops. The following observations on the insect were made.

The female *Tiphia* searches diligently for the *Lachnosterna* grubs in the ground, and seems to be very successful in finding tham even in fields in which they are not abundant. She lays only one egg on each grub : the ventral surface appears to be the safest position. Incubation of the egg and the growth of the maggot up to one-third of its size take several weeks, but after this growth is completed in two or three days. The larva pupates within a pear-shaped cocoon formed inside the cell prepared by the dying *Lachnosterna* grub. Pupation may not take place till the spring, but early larvae generally pupate at once and the adults soon emerge.

In the Middle West *Tiphia inornata* is undoubtedly the most important parasite of *Lachnosterna*, and may in some cases practically exterminate the pest over limited areas. The adult females are not strong fiiers and in cases in which *Lachnosterna* is rare they may die without finding hosts in which to oviposit. *Tiphia* is subject to a fungus disease (produced by *Isaria* sp.), and is parasitized by *Exoprosopa fascipennis* Say (Bombyliidae) and a beetle (Rhipiphoridae). It appears, however, that lack of host grubs is the most important check.

124 – ***Hypamblys albopictus* and *Zenillia pexops*, Parasites of *Nematus erichsonii*, in England.** — WARDLE, R. A., in *The Journal of Economie Biology*, Vol. 9, No. 3, pp. 85-104, 1 fig., plates IV-VI. London, 1914.

Researches carried out in 1913 in Cumberland on the means of controlling the large larch sawfly (*Nematus erichsonii* Htg.) (2) have shown a great reduction in the percentage of *Mesoleius tenthredinis* Morley, the well-known ichneumon parasite which was so abundant during previous years.

This diminution of the parasite did not always correspond with a diminution of the sawfly, but was accompanied by the appearance

(1) See *B.* Sept. 1914, No. 864. (*Ed.*).
(2) See *B.* Feb. 1911, No. 666. (*Ed.*).

of relatively large numbers of individuals of two other parasites not previously recorded, *viz. Hypamblys albopictus* Grav. and *Zenillia pexops* B. et B.

Hypamblys is an ichneumon closely allied to *Mesoleius* and has corresponding stages of development, though it reaches the adult stage several days before; it hibernates in the first larval stage. *Zenillia* is a Tachinid and is probably the parasite cited at different periods from 1910 on under the names of *Exorista crinita, E. alacris* and *E. dubia;* unlike other Tachinids it hibernates in the last larval stage; it pupates in the cocoon of the sawfly and the adult emerges almost at the same time as its host.

Since *Zenillia* appears to predominate at the expense of the ichneumon parasites, it is important that future researches should be directed towards the question of the respective value of the different parasites in the control of *Nematus erichsonii*.

125 – **The Food of Nestling Sparrows (*Passer domesticus*).** — COLLINGE, WALTER E., in *The Journal of the Board of Agriculture*, Vol. XXI, No. 7, pp. 618-623. London, October 1914.

During the years 1913 and 1914 the writer examined the stomach-contents of 287 nestling sparrows (139 in 1913 and 148 in 1914). Some of these were from fruit-growing districts (98 in 1913 and 102 in 1914) and the rest from suburban districts (41 in 1913 and 46 in 1914). Where possible the material was examined fresh, but in some cases it was preserved in alcohol.

The results are given in detail according to districts and dates, and are also summarised. It appears that one hundred nestling sparrows require nearly 2000 insects per day in fruit-growing districts and about a third of this quantity in suburban districts; except for a few spiders and earthworms, the whole of their food consists of injurious insects.

It seems probable that during the whole of the nesting-period the parent birds are eating food similar to that fed to the young.

In spite of all that has been written with reference to the depredations of the house sparrow, we do not yet possess that completeness of knowledge which would justify us in condemning it as a species that should be exterminated. That it is far too plentiful no one doubts, but seeing that practically all modern houses provide numerous safe nesting-places for it, this is scarcely surprising. The writer is of opinion that if this species were considerably reduced in numbers, the good that it would do would probably more than compensate for the harm, especially in fruit-growing districts.

126 – **Injury to Truck Crops by Spring-tails (*Smynthurus* sp.).** — FINK, D. E. (Entomological Assistant, Bureau of Entomology, U. S. Dept. Agr.) in *Journal of Economic Entomology*, Vol. 7, No. 5, pp. 400-401, plate 11. Concord, N. H., October 1914

In 1913 and 1914 spring-tails were found injuring seedlings of many plants in Virginia; they have been determined as a species of *Smynthurus* (Collembola), not *S. hortensis*. In general small irregular holes are eaten in the cotyledons. In one case in which the spring-tails occurred on potatoes,

they were found to feed on the eggs of the Colorado beetle (*Leptinotarsa 10-lineata*) as well as on the potato leaves. The species has been observed to feed on: lettuce, spinach, turnip, potato, tomato, cauliflower, cucumber and peas. In some cases cucumber seedlings have been completely destroyed; for these plants arsenite of zinc at 2 lbs. to 50 gallons of water was found successful in preventing damage.

127 – ***Rhagoletis pomonella* attacking Blueberries in Maine.** — WOODS, WILLIAM C., in *Journal of Economic Entomology*, Vol. 7, No. 5, pp. 398-400. Concord, N. H., October 1914.

In 1913 the Maine Agricultural Experiment Station received reports of a maggot infesting blueberries (*Vaccinium* spp.), which cover an area of some 250 000 acres in Washington County, giving rise to a considerable canning industry.

An adult bred from one of these larvae has been determined as *Rhagoletis pomonella* Walsh. (Trypetidae), known as the apple maggot. Other specimens caught among the blueberries were smaller than those from apples.

128 – **Fruit-Flies from Southern India** (1). — BEZZI, M., in *Bulletin of Entomological Research*, Vol. V, Part 2, pp. 153-164. London, 1914.

A systematic description of two new fruit-flies, *viz.*: *Bactrocera* (*Chaetodacus*) *bipustulata*, found in Mysore (March-April 1913), and *Monacrostichus crabroniformis*, from Yerkaud, Shevaroy Hills (April-May 1913).

The following are also mentioned: a) *Leptoxyda longistyla* Wied., found at Coimbatore (October 1913) on *Calotropis*; the specimens examined correspond to those found in Eritrea, in the Eastern Soudan (Casala) and in Senegal; the species has evidently been imported from tropical Africa with its host plant (*Calotropis procera*); b) *Dacus brevistylus* Bezzi, observed on melons at Siddhout, Cuddapale (April 1910); an African species very injurious to melons; this is the first record of its presence in India.

129 – ***Clinodiplosis oculiperda* Injurious to Newly-budded Rose, Apple and Plum in England.** — FRYER, J. C. F. (Entomologist to the Board of Agriculture) in *The Journal of the Board of Agriculture*, Vol. XXI, No. 7, pp. 636-637. London, October 1914.

During the past two years considerable damage has been done to recently budded rose, apple and plum stocks by a small maggot; the buds die, after becoming partly welded to the stock, and on examination small bright-red maggots are found below the bud or under the bark of the stock at the point of incision. The insect has been provisionally identified as *Clinodiplosis oculiperda* Rübs., belonging to the Cecidomyidae. These specimens came from Suffolk and Essex; it had previously been recorded in Herefordshire and Surrey under the name of the "red bud borer" (Theobald). Some growers seem to have known it for several years, but it is not known whether it is a native of Britain. *C. oculiperda* was first

(1) See also *B.* Feb. 1914, No. 190. (*Ed.*).

described in Germany, but does not appear to have been noticed elsewhere until 1913 (Angers, France).

As a means of protection against this pest, it is recomended to replace the raphia fibre for binding the buds by wool previously dipped in turpentine mixed with a little linseed oil and naphthalene, the threads to be dried before use. The most obvious means of preventing attack is by complete protection of the wound, and for this purpose grafting wax seems suitable.

130 – **Species of *Promecotheca* and *Bronthispa* injurious to Coconut Trees in Australasia.** (1) — FROGGATT, WALTER W., in *Bulletin of Entomological Research*, Vol. V, Part 2, pp. 149-152. London, 1914.

The ever-increasing demand for copra has resulted in an enormous increase during the last ten years in the area under coconuts in the Solomon Islands, New Britain, Papua, the Samoa Islands and the New Hebrides. Vast areas of virgin forests have been felled to give place to coconut plantations. The changes due to cultivation and the increase in number of palms have probably favoured the development of insect pests to a considerable extent.

Several beetles belonging to the genera *Promecotheca* and *Bronthispa* (fam. *Hispidae*) cause serious damage to coconuts in various parts of Australasia by feeding on the leaves in both larval and adult stages. In addition to the damage due to the mining of the insect in the leaves, the damaged leaves become centres of infection for fungoid diseases which are so widespread in the tropics. The leaf decays from the edges towards the midrib, which turns brown and decomposes at the point of junction with the stem and finally falls. The fruits, increasing in size without the support of the leaves, become detached under their own weight and fall while still green and unsaleable. Thus, the attacks of these beetles reduce the yield of nuts in proportion to their immaturity before the leaves are destroyed. In the year following the attack of the pest, the palms, having lost their lower leaves, require to produce new foliage before the next flowering period. The yield is therefore considerably reduced and very often the tree does not recover its former vigour for another year. The palm may succumb to the attacks of the pest, but owing to its powers of resistance this does not occur provided the terminal bud remains undamaged, unless the attack is followed by a long drought or other abnormal conditions.

The species enumerated by the writer are as follows :

1. *Promecotheca opacicollis* Gerst. (New Hebrides Coconut Hispid), known amongst planters as blight, fly or coconut beetle. This species has been recorded in the New Hebrides for 50 years. About 1905 it was recorded for the first time in the northern islands of the archipelago as injurious to cultivated palms, and three years ago there was a general outbreak of the pest in all the islands, from Sandwich to Santo.

2. *P. coeruleipennis* Blanchard (Fiji Coconut Hispid). This species is only injurious in the Fiji Islands ; though of similar life-history and

(1) See also *B.* March 1912, No. 598 ; *B.* June 1913, No. 764. (*Ed.*).

habits, it differs from the former in not being widespread throughout the archipelago. It occurs abundantly in March and April, but is effectively controlled by a Hymenopterous parasite in the egg stage as well as in the larval and pupal stages.

3. *P. antiqua* Weise (Solomon Is. Coconut Hispid). This beetle occurs in the Solomon Islands and has been previously recorded in New Britain and in German New Guinea, where it is injurious to the leaves of the coconut.

4. *P. callosa* Baly (Queensland Coconut Hispid). This species is found in the Northern Territory of Australia on native coconut palms; several specimens have been collected at Cape York (Queensland).

5. *P. varipes* Baly (Port Darwin Coconut Hispid), found at Port Darwin.

6. *Bronthispa froggatti* Sharp (Leaf-bud Hispa); the larvae of this beetle do not mine inside the leaves, but like the adults gnaw the epidermis of the opening leaves. Adults, pupae and larvae may be found on the same leaf, which on opening shows large blackened areas caused by the insects; when seriously damaged, the leaves decay from the tips downwards one after another, so that the growth of the palm is seriously affected. This beetle, described from specimens collected in New Britain, has been found in large quantities in the Solomon Islands. Its area of distribution is still more extensive, as it was found by the writer in 1903 in several places in the New Hebrides, where it was common on all young, sickly or damaged plants; but no cultivated or healthy palms were attacked here. The chief means of controlling the adults and larvae at first was by watering or spraying the leaves with a tobacco and soap wash; the difficulty of this method was in seeing that the natives carried out the operation properly. It was superseded by the method of collecting the adults and cutting away the tips of the infested leaves immediately the pest was discovered, and burning the cuttings with the eggs and larvae before they were able to damage the entire leaf surface.

131 – **The Large Poplar Longicorn (*Saperda carcharias*) and the Goat Moth (*Cossus cossus*) injurious to White Poplar (*Populus alba*) in the Lunigiana, Italy.** — Cecconi, Giacomo, in *L'Alpe: Rivista forestale italiana*, Series II, Year I, No. 11, pp. 351-356, figs. 1-2. Florence, 1914.

A poplar plantation at Avenza, near Carrara, of about 25 acres in area and consisting of 15-year-old white poplars about 50 feet high and 20 inches in girth, has been completely invaded by *Saperda carcharias* L. The numerous galleries bored in the trunk make the wood useless either for timber or as material for the cellulose industry. The damage caused by the beetle may thus be valued at some £3000.

Several specimens showing numerous signs of internal galleries were cut down and it was found that the upper portion of the damaged trunk was always mined with rather short galleries containing the Longicorn larva, while the lower portions towards the base had longer and more extensive galleries with blackened walls, in which were found caterpillars of the goat moth (*Cossus cossus* L.).

The writer considers that in this case most of the damage was due to the beetle and that the goat moths attacked the trunks when the tree had already been weakened.

Considering the conditions of the poplar grove, the writer advised controlling the attack by immediately cutting down all the trees and using the wood without delay. As it was also necessary to change the nature of the plantation, at least temporarily, and as in this case the poplars were planted alternately with alders, which appeared to be flourishing, he also recommended that this tree be replanted in the land occupied by the poplars, as at 14 years old alders are of considerable value in the smaller timber industries.

INJURIOUS VERTEBRATES.

132 – **Experiments on the Destruction of Voles by means of Danysz Virus, in the Gironde** (1). — BRUGIÈRE, P. L., in *La Vie Agricole et Rurale*, Year 3, No. 26, pp. 724-725. Paris, 1914.

At the end of June 1912 a plague of voles was reported on a farm in the Fronsadais (Gironde) consisting of about 400 acres, of which about 230 were under vines and 170 meadows and pasture. The plague assumed an alarming character during the latter part of summer after the hay harvest, which was a normal one. During the vintage the voles, though very abundant, caused no damage to the grapes, but confined their attacks to the meadows and prevented an aftermath being harvested. Pasturage was equally destroyed so that the cattle refused what little grass remained.

The hay crop off the old meadows was about 110 tons in 1912 and only 86 tons in 1913; unless some measures had been taken against the voles, there would have been no hay crop at all in the latter year, and it is very probable that after the complete destruction of the grass land the pest would have devoured the young shoots of the vines. The loss to this farm in hay and pasturage was more than £ 80, not including the loss due to the check to the growth of the new meadows.

In midwinter 1913(end of January), which was very wet, Danysz virus was used against the pest. According to data collected by the writer, the winter is more suitable than the summer for this work, since, owing to their lower vitality due to the unfavourable weather and scarcity of food, the voles are in a more receptive condition.

Coarsely ground oats were used as bait. Every sack of about 110 lbs. of oats requires 5 bottles of bouillon culture mixed with 3 ½ to 4 gallons of salt water containing 3 oz. of salt, the liquid being gradually mixed with the oats spread out on an impervious barn floor. In practice it is generally more convenient to take 5 sacks of oats with the corresponding quantity of bouillon and salt water, the salt being dissolved previously.

(1) See also *B.* 1913: March, No. 329; July, No. 897; *B.* Jan. 1914, No. 89. (*Ed.*).

The oats thus prepared are then spread in small handfuls at random over the soil, but not in small quantities at the entrance to the holes and passages as is sometimes recommended. However, in this case it was spread more abundantly along the mounds and raised parts where the voles' holes were more abundant.

The total expenses were as follows:

	£	s
4 400 lbs. crushed oats, at 9*s* 3*d* per sack	18	10
75 days' labour at 1*s* 9*d* (winter wages)	6	10
Total	£25	0

(The virus was supplied free by the Pasteur Institute).

The results obtained were complete and decisive. The activity of the voles ceased immediately, and after 7 or 8 days they had entirely disappeared. After ten days holes were opened at various places on the farm and groups of dead voles, sometimes as many as 11, averaging 5 to 6, were found. Since then no voles have been seen in either the grassland or the vineyards. The hay crop of 1913 suffered from the damage caused up to the beginning of February, but after the hay was saved the meadows gave excellent pasturage. Similar results were also obtained on neighbouring farms treated at the same time.

ALFREDO RUGGERI, *gerente responsabile*.

FIRST PART.

ORIGINAL ARTICLES

The Wine-Making Industry of California

by

FREDERIC T. BIOLETTI,

Berkeley, California.

California produced in 1912 about 47 500 000 gallons of wine, of which 22 491 000 gallons were sweet, fortified "vins de liqueur", approximately half red of "Port" type and half white of "Malaga" or "Marsala" type. The remainder consisted of red and white dry wine. The brandy produced was 6 153 000 proof gallons, used principally for fortifying the sweet wine. The growth of the industry has been continuous since 1857 when the production is stated to have been only 150 000 gallons of wine of all kinds and 6000 gallons of brandy.

Nearly half of this wine is shipped to New York and large quantities go to New Orleans, Chicago and others of the principal cities of the eastern States. About 1 000 000 gallons are exported to foreign countries, principally Hawaii, Central and South America, Canada, Mexico and a little to various European and Oriental ports. The remainder is consumed in the Pacific Coast States.

There are about 180 000 acres of wine grapes in California, spread over 42 of the 58 counties. About half the crop of the 75 000 acres of table-grapes and about one-sixth of the crop of the 150 000 acres of raisin-grapes are also used in the manufacture of wine, more particularly of sweet wine and brandy. This offers a valuable output for the table grapes which cannot be shipped owing to defective shipping qualities or over-production and for raisin grapes which ripen too late for drying.

The great bulk of the dry wine is made in the coast region, principally Napa, Sonoma and other counties bordering on the Bay of San Fran-

cisco ; this region produces most of the fine wines. Other large centers of production are the San Gabriel Valley in Southern California and San Joaquin County in Central California, where " bulk " wines are the principal output. Sweet wines are made throughout the great interior valley from Tehama County on the north to Kern County on the south, the chief centers of production being Sacramento, Stockton and Fresno. In the dry-wine districts the grapes are grown principally on slopes and rolling hills ; in the sweet-wine districts, on rich valley soil.

California produces four or five times as much wine as all the rest of the United States and owes its preeminence in this respect to its climate. This climate is characterized by a cool wet winter and a warm dry summer. Most of the rain occurs in December, January and February, and from June to September practically none falls. These are ideal conditions for growing varieties of *Vitis vinifera*, or European grapes, none of which can be grown commercially elsewhere in the United States owing to severe winter frosts which often kill the vines and to moist warm summers which prevent the control of fungous diseases.

The only serious fungous trouble of the vine in California is the *Oidium*, which is usually controlled easily by means of sulfur. Insect pests are occasionally harmful. The phylloxera has destroyed the vineyards in a few of the older districts, but they have been replaced by vines grafted on resistant stock. The progress of this pest is remarkably slow : in 35 years it has destroyed only about 75 000 acres and the greater part of the vineyards are still free.

All varieties of European and Asiatic grapes do well in California. The wine grapes of the north of Europe are at home in the cooler coast counties and those of the south in the warmer ones and in the interior. The Zinfandel, a vine of unknown origin, is the chief red grape, but many others are grown in large quantities. The principal among the red are Petite Sirah, Carignane and Alicante Henri Bouschet, and among the white Semillon, Colombar, Burger, Palomino and Riesling.

The crops, being subjected to few uncertainties of weather or parasites, are very regular in both quantity and quality. In spite of much defective work, owing to the lack of experience of a large part of the growers, the crops are on the average as large as in the best European grape-growing regions. The prices are not high, but a family can make a good living on twenty acres of wine grapes and do most of the work. The conditions and surroundings, especially in the dry wine districts, are very healthful and agreeable.

Formerly most of the wine was made in small cellars each on its own vineyard. At present much of the best wine is still made in this way. There is, however, a strong tendency to separate the business of growing grapes from that of making wine, especially in the sweet and bulk wine districts. Many large, central wineries have been established which work up the grapes for the neighborhood. These wineries often have no vineyard or only a small one necessary to comply with regulations of the Internal Revenue. Most of these wineries belong to wine-making com-

panies, though a few of them are established cooperatively by the grape growers.

The peculiar difficulties of wine-making encountered in all hot regions occur in the warmer parts of California. These are gradually being overcome by the use of modern improved methods. The region immediately bordering the Bay of San Francisco is specially favorable to wine-making, owing to its regularly cool and even climate. This region is not adapted to grape growing but much wine is made there from grapes shipped from the warm interior.

The methods of wine-making in use vary according to the kind of wine and the scale of operations. There is still a little wine made by the most primitive methods in small wineries scattered over the State; most of this is used for local consumption.

There are several wineries making over 1 000 000 gallons per year and many making half this quantity. In these cases, very powerful and efficient machinery is employed. Methods are not quite uniform, but the following are typical.

The grapes, arriving by train or wagon, are thrown on to inclined cement platforms from which they are taken by a continuous belt carrier to a crusher and stemmer. The largest of these handle several hundred tons a day. The crushed grapes, falling into a cement pit, are forced by means of a special "grape pump" through a 4-inch pipe to the fermenting vats. These vats, made of redwood, are open and hold from 2000 to 7000 gallons. The grapes are "sulfited" at the crusher with potassium metabisulfite and after a lapse of 6-12 hours a starter (often of pure yeast) is thoroughly mixed with the grapes by pumping over. "Foulage" by hand or by means of powerful pumps is practised about twice a day. The wine is dawn off and the pomace pressed as soon as the the required color and tannin are obtained. Cooling machines are used in a few wineries and are becoming more common every season. The common wine is stored in large redwood vats of from 5000 to 10 000 gallons or larger, and is racked once or twice before it is sold.

In smaller cellars, where fine wines are made, the general plan of operation is similar, but the fermenting and storage vats and casks are smaller and often of oak. Much of the wine is also aged in cool cellars before sale.

In general, wines resembling nearly all European types are made. In the cooler parts of the northern coast ranges, wines resembling those of the Rhine and Burgundy are made from Riesling and Pinot. In somewhat warmer localities, wines similar in type to those of Gironde, Sauternes and Piedmont are made from Cabernet, Semillon and Barbera. Bulk and common wines similar to those of Algeria are made in the warmer valleys from Zinfandel, Carignane, Mataro and Bouschet.

The general prospect for the future of the wine-making industry of California is encouraging. There is an ever-increasing market for the wine both in the United States and abroad. The production is limited only by the demand. Suitable land exists in abundance and California could produce as much wine as France.

Attempts are being made to include wine in legislation proposed for the prohibition of alcoholic beverages, but the well-known temperance of wine-drinking populations and the value of this industry to California will probably defeat these attempts.

The Principal and Most Recent Applications of Bacteriology to the Dairy Industry

by

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The dairy industry is eminently an industry of fermentations, and all those who have practised it from the remotest times, in the depeest ignorance of the existence of micro-organisms, have carried out without being aware of it ferment cultures in milk, cream and cheese : in milk by allowing it to acidify and to become effervescent in order to use it as a therapeutic beverage; in cream by allowing it to stand a length of time with the object of obtaining more savoury butter; and in cheese when ripening by the moderate and continued action of the ferments enclosed in the curd, with the result that a better flavoured and more stimulating and nutritious product is obtained.

But this multiform activity in the foods prepared from milk was due to spontaneous uncontrolled fermentations, which could only yield products lacking in uniformity and frequently lead to industrial failures. And such were the results of the milk industry until, with the discovery of the micro-organic world, the full importance of fermentations in dairying was recognized and gradually the science of the microbiology of milk was built up. This science has rendered dairying the greatest assistance in proportion to its progress, which, however, could not be rapid on account of the great number of micro-organisms that live in milk and its products, and of the complexity of their composition.

Thus at first the dairy industry began to make use of fermentative liquids obtained by the spontaneous fermentation of milk or whey, then of some selected ferments introduced into raw milk and at last of mixtures of several selected ferments added to pasteurised milk.

Such is the work accomplished by bacteriological investigation in the domain of the milk industry during little more than a decade. A good many problems still remain to be solved, retarding and limiting the spread of the most solidly established facts already acquired to science.

The present paper is a review of the most important studies on milk bacteriology and of their most recent applications. It deals chiefly with the preparation of the special fermented milks so much used at present in

therapeutics, with the most recent knowledge concerning the making of butter from ripened cream and with the use of pure starters in the production of the best-known cheeses on the international market.

Fermented Milks.

Among the well-known fermented milks largely used by ancient populations in the belief that they made for longevity, and which are adopted now by medical men in the control of the most frequent stomach and intestinal troubles and as tonics for debilitated organisms, the following are to be mentioned: *kéfir* of the inhabitants of the Caucasus and of the Steppes, *koumys* of the Tartars, *mazun* of the Armenians, *leben* of the Egyptians, *gioddu* of the Sards, and *yoghurt* of the Bulgarians.

Scientists have devoted much care to the study of this last preparation, supported by the trust placed in its therapeutical properties by so great an authority on bacteriology as Metchnikoff; they have extracted from it its prevalent ferments, of which they have made pure cultures to be developed in boiled milk, which is then used as food and medicament.

Thus of late years the pharmaceutical market has been invaded by a number of liquids or powders for the home preparation of Bulgarian milk or yoghurt, the essential element of which should be the typical ferment of Bulgarian maya or *Bacillus bulgaricus*.

It was only natural that these preparations, which were launched under the most attractive names, should be submitted to the investigation of scientific institutions in order to determine their efficacy and purity. The result was that in a short time a rich literature on the subject appeared, the conclusions of which, though they do not always agree with each other, we will endeavour to summarise.

According to Potter, *B. bulgaricus* is not of much avail in the control of the group of typhic diseases, while Belonosky declares in favour of the use of Bulgarian milk in affections of the intestine, observing, however, that the Bulgarian bacillus soon loses its vitality in milk possessing a high degree of acidity; he recommends saturating the acidity of the milk by the addition of 6 to 10 per cent of carbonate of lime, in order to maintain its virulence.

The writer also observed that the virulence of the commercial preparations of the Bulgarian ferment, when they are no longer very fresh, is considerably attenuated, though it can be restored by repeated cultures in sterilized milk.

The results of the investigations of Raebiger are also contrary to the commercial preparations of yoghurt. He found the powder cultures almost inactive and moreover infected with butyric ferments.

Griebel also recognised that these preparations are generally very impure; he considers the liquid ones preferable to the dry ones, as in the former *B. bulgaricus* is decidedly prevalent.

Michalowsky, in studying the way of using these ferments, has been able to conclude that practically the results are not very favourable,

because in private houses people do not know how to prepare yoghurt properly ; the fermenting milk is kept at too low temperatures, at which *B. bulgaricus* is overcome by the common milk streptococci.

On this subject WOLFF has written a monograph in which he reviews the various opinions on the effects of yoghurt, and concludes that the great majority of experimenters attribute considerable efficacy to preparations based on the Bulgarian bacillus provided that this ferment be the prevailing one in the milk and in full virulence.

BUTTER FROM RIPENED CREAM.

The milk product which was the first to derive advantage from the use of selected ferments and has steadily continued to do so with the surest results is butter.

The principle set forth by STORCH and confirmed by the experiments of HAASEN, WEIGMANN and many other bacteriologists, of the pasteurisation of cream followed by the addition of pure ferments developed in skimmed milk, in order to obtain butter with constant commercial characters, pleasant flavour and better keeping qualities than common butter, was soon adopted in dairy practise and especially by the large dairies engaged in international trade.

Having established their method, the experimenters turned their attention to its improvement, and it is in this direction that we report upon the latest research on the mode of using the selected ferments in the technique of butter-making and on the conditions which enhance the keeping qualities of the product.

ORLA JENSEN, in studying many Danish butters from various localities, found that the pure cultures of lactic ferments used in Denmark are represented by two quite distinct forms of ferments : one a small diplococcus, the other larger and moniliform. When these develop together they produce a more rapid and intense acidification than when each is by itself. But in the usual method of ripening cream these ferments do not keep long in the butter that is produced, as would be desirable ; on the contrary they are soon replaced by the lactic bacilli, which are more energetic, resistant and anaerobic ; at the same time yeasts, favoured by the acidity which they consume, begin to develop. For this reason butter made from sweet pasteurised cream possesses better keeping qualities than the butter made from ripened cream, as the American investigators ROGERS and GRAY also pointed out.

If certain precautions are not observed, the ripening of cream by means of selected ferments is a two-edged weapon. These precautions, according to JENSEN, consist in the use of pure lactic streptococci, the elimination of all the butter-milk from the butter by means of the most complete washing and working, followed by immediate cooling of the butter below 0° C. (32° F.).

The limits of temperature most favourable for this preservation, according to ROGERS and GRAY, should not be far from 0° C. (32° F.),

because they have found that though the initial bacterial content of refrigerated butter diminishes with the length of time it is stored, this decrease is more marked when temperatures about 0° C. are adopted than at temperatures of —10° and —20° C. (14° and —4° F.). These investigations lead to the practical conclusion that the usual method of using selected ferments in the manufacture of butter is destined to improve still further by a more rigorous selection of the ferments required, by the careful washing and working of the butter and by immediately cooling it to about 0° C. (32° F.).

To obtain a more marked aroma, which is often lacking, MAZÉ recommends that the fermentation of the cream, which normally lasts 18 hours, be lengthened by a further 24 hours, keeping the cream at a temperature of 15-16° C. (59°-61° F.), employing 15 per cent of ferment, after the cream has been pasteurised at 70° C. (158° F.) for five minutes. It should be kept out of contact with air and perfectly indisturbed.

RAW-MILK CHEESES MADE WITH STARTERS.

As soon as the bacterial flora of the various cheeses began to be known, it seemed an easy task to establish the technique of cheese-making, which until then had been empirical, on the basis of the use of starters.

The group of the peptonising or proteolitic bacteria of cheese, studied by DUCLAUX, being the one which lent itself more easily to the interpretation of the dissolving process of the casein of cheese, was the one from which forms of micro-organisms were drawn for attempts at their practical application. The experiments, however, yielded negative results, but the opinion as to the importance of these ferments was not abandoned until FREUDENREICH'S statement that the abundant existence of lactic ferments in cheeses pointed to them as being the chief agents in the making and ripening of cheese was corroborated by repeated investigations, at first in the European scientific institutions and then in those of America.

This is the chief feature of the bacteriological research on the technique of cheese-making carried on for little more than a decade, which has successfully prepared the way for the first applications of pure ferments to this branch.

Thus it is the lactic ferments which will cause new, gradually improving methods to be adopted in cheese-making, notwithstanding the great obscurity still prevailing as to the species of lactic ferments most appropriate to the different types of cheese, and still more as to those which, with their special aromas, take part in the specific qualities of these products.

Among the most important recent instances of the employment of pure ferments in cheese-making with raw milk, the first place is occupied by the Swiss cheeses, due to EDMUND VON FREUDENREICH. with the assistance of his distinguished pupils ORLA JENSEN and I. THÖNI. Almost on the same experimental lines, the cheeses of other countries were also studied with the same objects, and especially the Italian Grana cheeses, the Dutch

Edam and Gonda, American Cheddar and the soft French cheeses of the Brie and Camenbert types.

The FREUDENRECIH-THÖNI process divulgated by the Bacteriological Laboratory of Liebefeld (near Berne) since 1906, has the object of preparing a pure culture of lactic ferments in the rennet solution which the Swiss cheese-makers prepare every day, in order to ensure the success of the cheese and the improvement of its quality.

The first confirmation of the practical success of this process came from the Berne School of Cheese-making at Rötti, and gradually it gained the confidence of practical men, to such an axtent that BURRI, the present director of the above-mentioned Laboratory, reported lately that in the two years 1910-11 it sent out no less than 14 825 bottles of pure starters, and that now, in order to meet the wishes of cheese-makers, it is endeavouring to prepare the same cultures under the form of powder capable of preserving its full activity for at least two months.

The bottles contain a little over 200 cc. of sterilised milk whey inoculated with *Bac. casei epsilon* and a *Mycoderma* which has been studied by THÖNI, which enhances the fermenting power of the lactic bacillus.

The culture is used in the following manner: about half of the contents of a bottle is poured upon the calf stomach membrane cut into small pieces in a sterilised vessel; after three or four hours' contact a sufficient quantity of boiled whey is added and the whole is left to ferment at 30° C. (86° F.) for a day and a half or two days, after which the fermented liquid is used as rennet and starter in the manufacture of Swiss cheeses.

In view of these successful results, other experiments were made in Austria and in Germany. During the two years 1909-10 experiments on a large scale were made in private cheese factories in Württemberg, West Prussia and Allgäu in Hanover, to which 1200 cultures of ferments were distributed with the pure cultures prepared by the Experimental Cheese-making Institute of Memmingen.

From an enquiry made by G. WENGER it appeared that the pure cultures used in the making of Emmental represent an efficient means of increasing the certainty of results, because they solve the question of the preparation of a normal rennet solution, allowing at the same time the elimination of all the defects at present known in the rennet prepared according to the old methods. It seems, however, that they are not sufficient to correct the defects of the milk, against which all the hygienic measures formerly applied must be maintained.

The observations of GRATZ and of the writer on the effect of FREUDENREICH'S pure ferments in the manufacture of cheeses of types different from Emmental are interesting.

GRATZ, having prepared Limburg cheese with *Bac. casei epsilon* in the dose of 0.5 to 1.0 per cent, observed in the ripe cheese a flavour more marked than normally and recalling that of Swiss cheeses, and the writer, on using the same culture in the manufacture of Reggio Grana, obtained products which both for their eyes and texture, as well as for their flavour, approached the characters of Gruyère.

On the same Limburg cheese and on the Ovärer type, GRATZ also used two varieties of lactic ferments of the *Bact. güntheri* group in doses of 0.5 to 2 per cent, which showed that cheeses treated with the pure ferments acquired a finer taste and that their texture had a better appearance than the control cheeses; he observed further, in the Limburg cheeses, the disappearance of the bitter taste which is so frequent a blemish in cheeses made according to the old methods. These results induced him to introduce the systematic use of these cultures into his cheese factory.

In Italy the type of cheese which has been treated most extensively with selected ferments is the Grana, both the Lombard or Lodi, and the Emilian or Reggio.

During the last ten years and more, GORINI, of the Milan College of Agriculture, has attended to the practical application of the selected ferments obtained by him in his investigations into the manufacture of several Italian cheeses, but especially of the Lombard Grana, according to a process which has been spread by the Pro-Grana Association of Milan and following which several thousand cheeses have already been made.

This process is based on the purity and wholesomeness of the milk and on the use of selected ferments, that is lactic caseophilous bacteria. With these ferments a culture must be prepared with boiled and filtered whey and selected ferments, called "scotta cultura" and then left at 35 to 40° C. (95 to 104° F.) until it attains 10 to 14 degrees of acidity Soxhlet.

At the Lodi Cheese Experiment Station also, the application of pure lactic ferments in the manufacture of Grana and some other cheeses has been attempted, especially by SAMARANI. In this case a method has been followed that differs somewhat from the one above described. It is founded on the cooling of milk and on the use of a culture of a lactic bacillus endowed with great virulence which has been developed in whey and is added to the milk at the rate of one per thousand. With this dose the proportion of added ferments to the others is about 80 per cent.

As this bacillus requires a suitable temperature for its rapid development, ranging from 35 to 40° C. (95 to 104° F.), the cheese has to be kept at this temperature for at least 24 hours, after which the lactose may be considered decomposed. Consequently the cheese must be put at once into a warm chamber at the above temperature and kept moist by a sufficient bulk of boiling water.

I also have been for a long time interested in the improvement of the manufacture of the Grana cheese of Reggio (1), and I experimented, at the dairy of the Royal School of Animal Husbandry and Cheese-making of Reggio Emilia, with cultures of selected lactic ferments isolated from the so called "siero-innesto", a whey produced by spontaneous fermentation of cheese whey, which has for long been used by the cheese-makers of Emilia in order to diminish the number of failures in their products. The ferments isolated were a lactic streptococcus of the type of *Streptococcus guntheri* and a lactic bacillus of the *Bacterium casei* group; after being

(1) See *B.* Jan. 1915, No. 103. (*Ed*).

successfully used in many experiments, these were adopted with the same favourable results in several private cheese dairies in Upper Italy and especially in Emilia.

The new technical process of the manufacture of Reggio Grana cheese founded on the above basis consists in :

1. Use of the milk of two milkings obtained with due sanitary precautions and cooled during the summer months.

2. Preparation of the whey starter by the mixture of two cultures of lactic ferments developed in pasteurised milk-whey and kept at a temperature of 30-35° C. (86-95° F.) until it reaches a degree of acidity Soxhlet per 50 cc. ranging from 12 to 15.

3. Daily perpetuation of the initial whey starter into other whey, as for butter starters, so long as the culture keeps its requisite characters.

4. Daily dosing of the starter for every quantity of milk according to the degree of acidity attained and to that of the milk.

5. Acidimetric control of the milk during the process, and of the whey ferment and the whey in the boiler during the various stages, in order to produce at the end a fermentation acidity equal to 0.5-0.6 of lactic acid per 1000.

As, according to circumstances, it was found desirable to determine the reciprocal influence of one form of lactic ferment upon the other on the quality of the produce, a new series of researches was conducted from this point of view, using fermented wheys in which sometimes streptococci prevailed and other times lactic bacilli.

These experiments confirmed those previously mentioned as to the influence of *Bacillus casei epsilon* on the texture of Grana. The whey starters with prevailing lactic bacilli yielded cheeses which in texture resembled Gruyère, while when cocci prevailed the cheese revealed all the best characters of the typical Reggio Grana, as will be seen from the accompanying figs. 1 and 2.

Another important technical observation was made in this experiment, namely that when the lactic streptococci prevail in the whey-starter the desired degree of fermentation acidity is produced during the course of the cheese-making, while the prevalence of the lactic bacilli renders this acidity almost imperceptible at the end of the operation.

On the same scientific lines followed by me with the object of rendering the making of Grana more certainly successful, the Cheese-making Experiment Station at Hoorn, Holland, proposed the improvement of the technique of the manufacture of Dutch cheeses, by isolating from the ropy whey (lang-wei) used by practical cheese-makers, a ferment which when used in pure cultures has given much surer results than the lang-wei, and, according to VAN DER ZANDE, allows a more rapid ripening of the cheese, improves the characters of the rind and diminishes its swelling.

Being acquainted with the works of HASTING, EVANS and HART on the bacterial flora of Cheddar cheese, which is produced on so a large scale in the United States of America and in the United Kingdom, Miss ALICE EVANS used in the manufacture of this cheese a mixture of common lactic ferments and of pure cultures of *Bact. casei*. She observed that during the making

Influence of the composition of the selected ferment on the texture of Reggio Grana Cheese.

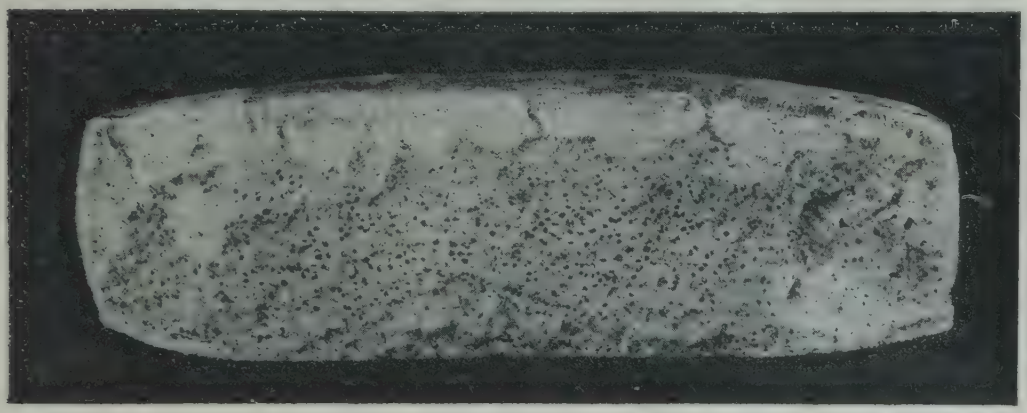


Fig. 1.

Cheese prepared from raw mil with a selected ferment of streptococci and lactic bacilli, the former predominating, after ripening for 2 ½ years.

Typical Reggio Grana texture.



Fig. 2.

Cheese prepared from raw milk with a selected ferment of streptococci and lactic bacilli, the latter predominating, after ripening for 2 ½ years.

Texture of Gruyère type.

of the cheese the lactic ferments prevail over the caseo-bacteria, but as soon as the cheese is made the former decrease rapidly in numbers; the caseo-bacteria diminish also, but so slowly that in the ripe product they are prevalent.

Besides the two above-mentioned types of ferments, an abundance of streptoccocci and micrococci were also found; hence Miss EVANS believes that the proportional association of the four groups of ferments prevalent in Cheddar will mark a progress in the technique of this cheese.

CHEESE FROM PASTEURISED MILK WITH SELECTED FERMENTS.

Whilst, as we have seen, several lactic ferments in pure cultures have already been adopted with raw milk in the usual technique of the cheese dairies in several countries, the processes of making cheeses, and especially hard cheeses, from pasteurised milk, employing selected ferments, is still in the experimental stage, with some few exceptions in the making of such soft cheeses as Brie and Camembert.

It is due to the Parisian scientist P. MAZÉ, of the Pasteur Institute, that the technique of the manufacture of these soft cheeses *de luxe* has undergone such a transformation as to afford a typical example of a perfectly scientific method of cheese-making. His process, announced in 1905 at the Second Dairy Congress in Paris, was immediately adopted in current practice by the two great cheese factories of Guérault-Godard at Fère Champenoise and of Renard-Gillard at Biencourt.

Owing to the good practical results of his method, MAZÉ, proclaimed at the next Congress (at the Hague in 1907) the principle that the use of pure ferments together with the preliminary pasteurisation of milk is a method applicable to all cheeses, when the nature of the ferments to be employed and the quantity of them to be added to the milk are carefully determined.

The Mazé method starts with the pasteurisation of the milk at 65° C. (149° F.) for five minutes in a special pasteuriser invented by him. This pasteurisation, while it does not alter the successive action of the rennet, prevents the existence of any ferment injurious to the manufacture of the cheese. After it has been pasteurised and duly refrigerated, the ferments must be added to it. They consist of three different groups of pure ferments isolated by the same experimenter, which have been shown by theory to be capable of an efficient specific action.

They are: 1) a culture of lactic ferments; 2) a culture of moulds and mycoderms; 3) a culture of casein ferments.

The lactic ferment group must be added to the milk a little before curdling, as it possesses a protective power against contamination. It is used under the form of curdled milk.

The yeasts and moulds are grown in solid nutritive media; these must be used moderately, because in general plenty of them are present in cheese factories on the utensils, whence they pass into the curd.

The casein ferments are cultivated in nutritive broth, and as they would lose some of their activity in contact with the lactic ferments, they are added successively, allowed to develop and dried on the *cagets*.

The rest of the operations of cheese-making are conducted very much in the old way.

GUÉRAULT, after two years of continued use of this method in his cheese factory, reported at the Fourth International Dairy Congress (Budapest, 1909) that in working up daily 2200 gallons of milk into soft cheeses he had been able to observe favourable results both in the improvement of the product and in the complete disappearance of the disease known under the name of *graisse*, which was very frequent in the Brie cheeses produced by the old methods.

At the same Congress Mlle. DE VILLERS, of Grands Champs in Belgium, who attempted there the manufacture of Brie and Camembert cheese, following Mazé's method, observed that Mazé had supplied the cheese industry with a sure method and an apparatus of remarkable precision, though the success of the various operations requires the direction of an intelligent man possessing good practical experience and some notions of bacteriology.

In Germany also Mazé's method was applied to the same cheeses. KLOSE made some attempts on a small scale, which enabled him to conclude that if the cheese is ripened at a temperature not above 12° C. (53° F.), the Mazé process is advantageous, and that it will prove useful for the manufacture of soft cheeses in the German dairies.

Meanwhile the American scientific institutions which had at first concentrated their investigations on the ripening of cheese by the soluble ferments of milk and of rennet, following the school founded by BABCOCK and RUSSELL, were not long in recognising the importance of the lactic ferments and of proposing their employment in the manufacture of Cheddar cheese with pasteurised milk.

SAMMIS and BRUHN, at the Wisconsin Agricultural Experiment Station, undertook experiments in this direction, the results of which were soon adopted in practice, so that in the two years 1910-11 two thousand dollars' worth of Cheddar cheese made with pasteurised milk were sold in the principal cities of North America.

This process of making Cheddar is founded on the pasteurisation of milk with the addition of a suitable solution of hydrochloric acid (to return to the milk its faculty of coagulating), and of excellent rennet at the rate of 2 per thousand, as well as of a pure culture of butter lactic starter, that is of streptococci. All the successive operations are carried out according to well-established rules.

The cost of this process is valued at about one-fifth of a cent per gallon; this is balanced by a greater yield of chee se, estimated at 4.22 per cent, and due to the smaller loss of fat and to the greater quantity of water retained by the cheese.

Attempts have been made by Miss EVANS to prepare Cheddar cheese with pasteurised milk and a double culture of lactic streptococci and caseo-

bacteria, but they do not appear to have been successful, because *Bact. lactis acidi* prevails over the bacilli during the ripening of the cheese in such a manner that the product does not acquire its full aroma and takes twice the normal time to ripen.

In Italy the manufacture of Grana, Cacio-cavallo, and some soft cheeses with pasteurised milk has been tried.

In particular, SAMARANI based many experiments on pasteurisation, turning into cheese nearly 88 000 gallons of milk. From his experiments he gained the conviction of the final triumph of pasteurisation in the technique of cheese-making, at least in large factories.

The process followed consists in the pasteurisation of milk at 65-70° C. (149-158° F.), in the addition of calcium chloride in order to return to the milk its property of coagulating and in a culture of lactic ferments developed in whey.

The advantages announced by this experiment are that pasteurisations especially in soft cheeses, improves the characters of the curd and increases the yield of cheese, in connection with the degree of temperature adopted for pasteurising.

GORINI also conducted experiments on the manufacture of Parma Grana cheese by pasteurising the milk at 80° C. (176° F.) and adding pure cultures ; but they were not encouraging, as the cheese that resulted did not present the texture and the ripening which are characteristic of Grana. Successive experiments made with milk pasteurised at only 65° C. (149° F.) were more satisfactory and led to the belief that it is possible to make such cheeses with milk pasteurised for a few minutes at this temperature.

But on account of the changes which milk always undergoes on being pasteurised, of the inefficacy of too low a temperature in destroying injurious ferments, and of the possible suppresssion of some groups of ferments useful for the ripening of cheese, many writers criticised and still criticise pasteurisation in the manufacture of cheese.

For these reasons a system was thought of, which should avoid any alteration of composition of the milk and at the same should render it free from ferments. Miss GERDA TROILI PETERSSON, a Swedish lady, used peroxide of hydrogen in the manufacture of Güter cheese with selected ferments. She warmed the milk to 52° C. (125.6° F.), then added 1.3 to 1.5 per 1000 of peroxide of hydrogen and allowed the milk to stand for about 5½ hours at that temperature ; the peroxide decomposes and gives rise to nascent oxygen, an antifermentative. The cultures that she afterwards employed were lactic bacteria, liquefying cocci and glycerine ferments.

The results obtained were satisfactory, but hitherto they have been confined to laboratory experiments.

CONCLUSIONS.

Sumarising the results of the use hitherto made of selected ferments in the cheese-making industry in every country, we may say that the pure cultures of lactic ferments, cocci or bacilli according to the type of cheese,

when added to raw milk have afforded tangible results which have led to their adoption in practical cheese factories, especially for the elimination of the principal and most frequent defects in the products.

This has marked a great progress towards perfecting the cheese industry. But a good deal remains to be done. To determine which of the typical forms of lactic ferments at present known are more ad vantageous to one cheese than to another, to what extent they are to be used and with what precautions, are all important problems the solution of which has hardly commenced to be taken in hand, and which represent a considerable mass of work laid before bacteriologists ; these must, as JENSEN said at the recent Congress at Berne, each select a special group of bacteria according to the type of cheese under investigation; they must then study it in its minutest details. It would be impossible for every experimenter to breed all the bacteria of importance to the dairy, as the work requires too much time and the breeding of each group demands special experience.

The completion of this undertaking will doubtless lead the manufacture of cheese with pasteurised milk to more practical and tangible results. At present this process, with the exception of some isolated applications, is still enveloped in uncertainty, but it will eventually solve the greatest problem which occupies scientists engaged in furthering the progress of the dairy industry.

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Development and Present State of Dairying in Sweden.

by

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The origin of the dairying industry in Sweden is extremely ancient and the breeding of cattle and the making of butter and cheese played an important part in the rural economy of the country up to about the end of the sixteenth century. Then a long period of stagnation and decadence set in, but in the middle of the nineteenth century agriculture underwent a transformation which determined a new rise of the milk industry : after having aimed chiefly at the production of cereals, farmers began to take an ever increasing interest in breeding, especially in connection with the production of milk. The manufacture of butter and cheese was transformed from a domestic pursuit into a veritable industry, which has continually gained in importance for the economy of the individual farmer as well as for that of the whole country.

According to recent statistics (1911), the total number of cows (above two years of age) is 1 837 035. Comparing this figure with the number of inhabitants for the same year (5 561 799) and the total area of arable and grass land (12 258 236 acres), it will be seen that there is in Sweden 1 cow for every three inhabitants and for every 6½ acres of cultivated land.

The total production of milk is estimated at 6600 million pounds. Of this quantity about half is consumed as such ; a fairly large proportion is used for the feeding of young animals or is transformed into cheese and butter at the homestead , especially in the least densely populated districts ; there remain only about 2200 million pounds for the dairying industry proper. This quantity is increasing progressively, as is shown by the following figures :

Milk delivered to the dairies.

Year	Quantity lbs
1890	1 115 784 000
1895	1 634 598 000
1900	1 856 909 000
1905	2 024 046 000
1910	2 533 593 000

As the quantity of milk delivered to the dairies increases, the number of the latter diminishes : thus in 1890 there were 1562 dairies, while in 1910 there were only 1416 of them, so that of late years they have increased in size.

According to their economic arrangement, the dairies may be divided into four groups :

1. Cooperative dairies, in which the milk is worked up for the combined producers.
2. Purchasing dairies, which buy the milk from the producers and keep the profits for the shareholders of the dairy.
3. Dairies belonging to large estates which work up their own milk.
4. Dairies belonging to large estates which also buy milk, thus occupying an intermediate position between classes 2 and 3.

The decrease in the number of dairies, mentioned above, does not apply to cooperative dairies, the number of which has shown a steady increase. In 1905 and 1910 the number of the dairies belonging to the various classes was as follows :

	In 1905	In 1910
Cooperative dairies	470	550
Purchasing dairies	536	475
Large estate dairies	399	278
Large estate purchasing dairies	170	113
Totals	1 575	1 416

If the amount of milk weighed and delivered at the dairies be divided by the number of the latter, it is found that each of them works up about 4400 lbs. of milk per diem. The size of the dairies varies considerably. In the north they are very small ; in the south, where the population is denser, they are relatively large.

Upwards of 60 per cent of the dairies produce only butter, a little over 15 per cent make butter and cheese, and about 25 per cent only cheese. As the latter are generally small, it may be said that the chief object of the dairy industry in Sweden is the manufacture of butter, as is also proved by the following table :

Produce of the Swedish dairies from 1880 *to* 1910.

Year	Butter	Whole-milk cheese	Skim-milk cheese
	lbs.	lbs.	lbs.
1890	35 479 800	3 848 300	10 691 240
1895	54 953 850	4 681 040	10 562 750
1900	57 571 500	7 199 700	9 192 650
1905	61 728 050	9 790 070	9 253 870
1910	72 616 750	12 494 950	9 851 210

The proportion between the amounts of butter and cheese turned out varies somewhat during the course of the year ; the low prices of butter during the summer cause the manufacture of cheese to increase until the autumn, when the price of butter invariably rises again.

As dairies chiefly make butter, the milk is generally paid for according to its content in fat. As far as the information goes, such is the case in about 80 per cent of the dairies ; most frequently the fat content is determined by Lindström's butyrometer.

As a rule the dairies are well managed ; in particular those that manufacture butter are equipped with the most modern machinery. The milk and cream from which butter is made are always pasteurised ; for this operation either the ordinary pasteuriser is used or, more frequently, the regenerating pasteuriser in which the heat given off by the pasteurised milk is used to warm the cold milk entering the pasteuriser or the separator. The cream is ripened by means of lactic ferments at a temperature of about 12° C. (53.6° F.) during 15 to 20 hours. As a source of lactic ferments sour milk is used ; this is obtained by the Alnarp Dairying Institute's method. In all the large dairies churning is done now in the separator churns (Butterfertiger) ; in the small dairies one still finds the Holstein churns, the adoption of which in Sweden dates far back. The butter is slightly salted during the operation. Packing is done in barrels (drittel) containing about 110 lbs. each.

A small proportion of the butter made in the industrial dairies is consumed in the country itself; the rest is exported. From 1904 to 1913 the quantities exported were as follows :

Year	tons	Year	tons
1904.	19 222	1909	18 720
1905.	18 110	1910	21 405
1906.	15 943	1911	21 826
1907.	17 065	1912	10 902
1908.	17 872	1913	29 344

Of the above quantities about 75 per cent goes to Great Britain, 21 per cent to Denmark and 4 per cent to other countries.

Of late years a certain amount of cream has also been exported, chiefly from the dairies in the south of Sweden ; in 1912, 7 622 700 lbs., and in 1913, 14 827 070 lbs. were exported, of which 95 per cent went to Germany.

From the above it will be seen that the manufacture of cheese is not very important. Nevertheless the table showing the output of the Swedish dairies proves that the manufacture of whole-milk cheese has greatly increased during the last twenty years. Cheese is not exported from Sweden to any great extent, and of late years the quantity imported has been about one million pounds per annum. As for the quality, Sweden produces almost exclusively hard cheeses, especially with small eyes, though some with large eyes are also made.

Among the best known varieties the following may be mentioned :

1. *Swedish large-eyed cheese*, which in type and appearance resembles the Swiss Emmental cheese ; it is about 14 inches in diameter and 4 $^3/_4$ in. high.

2. *Norrland whole-milk cheese* with small eyes, and very soft; it has a slightly pungent taste; its diameter is about 16 inches and its height 6 in. It is made both with and without spices (caraway and cloves).

3. *Småland shepherds' cheese*, resembles the preceding, but is more pungent and more compact. It is never spiced.

Besides these essentially Swedish cheeses, imitations of most of the well-known Dutch and English cheeses are made.

The skimmed milk of the butter dairies and the whey of the cheese factories is mostly used for the feeding of live stock ; a certain quantity of skimmed milk is used in the manufacture of skim-milk cheeses and of casein, coagulated by lactic acid. A very small proportion is utilised by making milk powder.

With the whey submitted to evaporation, the cheese called " mesost " is made, especially in the north of Sweden. It contains the solid constituents of whey and consequently much lactose. Pure milk-sugar is also produced, thoughly only on a small scale.

Encouragement to the milk industry. — In order to ensure a good and uniform quality of the butter exported, the latter is subjected to regular control and the dairies which turn out a butter fulfilling certain conditions are given the right to attach to the butter barrels a national registered mark attesting the high quality of the product. This control is under the supervision of the Direction of Agriculture and it is entrusted to a Commission of delegates of the provincial societies of rural economy. They are allowed a subvention from the State and a yearly fee of 40 kröner (44*s*) is due by every dairy under control, but this fee is generally paid by the society of rural economy of the province. For each dairy an inspection is made at least once in winter, once in summer and once in autumn, and it consists in the examination of one barrel of butter taken, without previous notice, from the exporter and without the judges knowing the place of origin of the butter. The butter is examined as to the following points: *a*) quality, *b*) packing, *c*) brine content, *d*) defects. Once each season the degree of pasteurisation, the refraction index of the fat and its content in volatile acids are also determined.

The judges who make the inspections are dairy instructors, with a certain number of butter merchants. Each judge estimates the butter by himself and awards marks ranging from 1 to 15. Figures above 10.5 represent butter exempt from defects. Before a dairy is entitled to use the mark of registered quality its butter must have been classed 10.5 at least twice, it must not contain more than 16 per cent of water, and must be of satisfactory consistency. After the examination, the dairy and the instructor of the district in which the dairy is situated receive the verdict on the product, as well as remarks on the same and advice. At the end of the year the Direction of Agriculture publishes a report on the work of inspection, and a list of the dairies enjoying the privilege of using the national butter mark. According to the Orders of May 26 and August 11, 1911, it is also forbidden to export butter containing more than 16 per cent of water or to send it in packages that have already been used.

Besides this official butter control, which is carried on in the exporting ports, the provincial societies of rural economy organise, in the localities which they deem most suitable, separate inspections with the object of affording the producers themselves an occasion of examining the quality of their butter under competent guidance.

Up to 1896, the Danish market prices were generally used as a basis of the accounts between the butter merchants and the dairies. The uncertainty, however, of these quotations gave rise to official Swedish reports on the average prices paid for first-class butter during the preceding week. This report, which is published every Thursday, is the average of two reports, namely, of the price of first-class butter sold the same week in England plus 3 öre per kilogram (0.18*d* per lb.) minus the cost of carriage

and sale, and of a price based on the Swedish statistics of the prices paid at the dairies plus 1 öre per kilogram (0.06*d* per lb.) representing carriage from the dairy to the shipping port. The Executive Committee of the Butter Control is entrusted with the management of this price list, which is used as a basis in the transactions between the export merchants and the dairies and between these and the farmers.

In order to extend the manufacture of Swedish cheese, exhibitions have been organised, in which the cheeses are examined and judged. Besides this a special Commission visits dairies and examines the cheeses in storage.

The State and the subventioned provincial societies of rural economy have in their service instructors, whose duty it is to give advice to the dairies and inform them of the improvements they might introduce into their work or of the defects to be avoided. The number of these instructors is 25 at present. The societies of rural economy support also "societies for milk control", which are formed by the union of several neighbouring dairies and which club together to defray the cost of an inspector entrusted with the sanitary inspection of the milk supplied to the dairies.

Instruction in dairying. — Instruction is given in the following places:

1. The State Dairy Institute at Alnarp, where the course lasts one year and includes two divisions. In order to be admitted to the upper division students must: *a*) have passed the final examination of one of the agricultural institutes of the country; *b*) have taken an active part in all the work occurring in a dairy. For admission to the lower division the student must: *a*) have attended all the classes of the primary communal schools; *b*) have taken active part for at least one year in all the work occurring in a dairy.

2. The State Dairy School at Åtvidaberg, where the course lasts six months. The conditions of admittance are the same as at Alnarp; nevertheless preference is given to persons who have already attended some other dairying educational establishment. At Alnarp and at Åtvidaberg instruction is free of charge, but the pupils pay for their board.

3. The State Dairy Stations, established in private dairies enjoying a good repute and managed according to modern requirements. In these Stations the course lasts two years and includes both theory and practice, the former being given mostly in the second year. Several pupils of the first year are sent together to some large dairy where theory is taught by the dairy instructors of the societies of rural economy. The pupils are instructed and boarded free of charge and get besides a yearly allowance of 75 kr. (£4 2*s* 6*d*) for clothing.

The number of pupils who issue yearly from the dairying schools is about as follows:

1. Alnarp	Upper division	2 to 3
	Lower division	10 to 15
2. Åtvidaberg		15 to 20
3. State Dairy stations		30 to 35

The *Swedish Machine-testing Societies* try all the new types of dairy machinery, and publish reports, with the results of such tests, from which the dairies get the necessary information when they wish to purchase new apparatus.

Experimentation in dairying is carried out under the direction of the Central Agricultural Experiment Station. Up to the present, dairy experimentation proper has been conducted at the Alnarp Dairy Institute, while the questions concerning dairy bacteriology have been dealt with at the Bacteriological Laboratory of the Central Institute at Experimentalfältet. The reports on the results of experiments appear in the Special Bulletin of the Central Institute and in the special Swedish press.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

133 – **United States Fertilizer Laws.** — *The American Fertilizer Hand Book*, Seventh Annual Edition, pp. 54-59. Philadelphia, Pa., 1914. (Comunicated by Dr. A. C. TRUE, Chairman, *Committee on Relations with International Institute of Agriculture*).

The following is a brief digest of the State fertilizer control laws, tonnage tax, license fees and names and addresses of State Fertilizer Officials, in the various States.

ALABAMA. — *Registration.* Each and every brand of mixed fertilizer or fertilizer material to be offered for sale shall be registered with Commissioner of Agriculture, annually before December 1st of each fiscal year, and a fee of $5.00 paid for each brand registered. — *License.* A general license of $1.00 is required from each and every person selling mixed fertilizers or fertilizer materials in the State. — *Tag Tax.* 30 cents per ton. — *State Fertilizer Official.* Commissionner of Agriculture, Montgomery, Ala.

ALASKA. — No fertilizer law.

ARIZONA. — No fertilizer law.

ARKANSAS. — *Registration.* Manufacturers, jobbers and manipulators of cottonseed meal, commercial fertilizers, and fertilizer materials, shall file with Commissioner of Mines, Manufactures and Agriculture, the names of the brands, addresses of manufacturer and the guaranteed analysis. — *Tag Tax.* 25 cents per ton. — *State Fertilizer Official.* Commissioner of Mines, Manufactures and Agriculture, Little Rock, Ark.

CALIFORNIA. — *Registration.* Manufacturers, importers, agents of, or dealers in commercial fertilizers, or materials the selling price of which is over $8.00 per ton shall obtain a certificate of registration from the Secretary of the Board of Regents of the University of California. Registration fee $50.00, which expires on June 30th of the fiscal year for which given.

Brands and their analysis to be filed before July 1st of each year. Samples of fertilizers will be analysed for consumers for $2.00, by Director of Agricultural Experiment Station. — *Tag Tax.* 25 cents per ton. — *State Fertilizer Official.* Fertilizer Control, Agricultural Experiment Station, Berkeley, Cal.

COLORADO. — No fertilizer law.

CONNECTICUT. — *Registration.* Before any commercial fertilizer is sold, or offered for sale, manufacturers, importers, and persons offering for sale shall file with the Director of the Connecticut Experiment Station two certified copies of a statement giving each name, brand or trade mark under which the fertilizer is sold, the names and address of the manufacturer, the place of manufacture and the chemical composition of the fertilizer, and shall deposit with the Director a sealed glass jar containing not less than one pound of each brand to be offered for sale. — *Analysis Fee.* The manufacturer or seller shall pay on or before May 1st, annually, an analysis fee of $10.00 for each of the fertilizer ingredients contained in said fertilizer. — *State Fertilizer Official.* Director of Agriculture, Experiment Station, New Haven, Conn.

DELAWARE. — *Registration.* Every manufacturer or importer of fertilizer before offering the same for sale in the State, shall file with the State Chemist a paper giving the name of his principal agents and also the names and guaranteed analysis of the brands of fertilizer offered for sale by him. — *Analysis Fee.* Every manufacturer, importer, agent or seller of any fertilizer shall pay annually to the State Chemist an analysis fee of $ 20.00 for each and every brand offered for sale within the State. Agents are not required to pay fee, if already paid by the manufacturer. — *State Fertilizer Official.* State Chemist, Newark, Delaware.

FLORIDA. — *Registration.* Any manufacturer, importer of, or agent for the sale of commercial fertilizers, previous to offering the same for sale in the State shall file with the Commissioner of Agriculture annually a paper giving the name of his principal agent, or agents, in the State, also the name and guaranteed analysis, under oath, of the fertilizers offered by him for sale. — *Inspection Tax.* 25 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture, Tallahassee, Florida.

GEORGIA. — *Registration.* All manufacturers, jobbers and manipulators of commercial fertilizers or fertilizer material, who may desire to sell in the State shall file with the Commissioner of Agriculture the name of each brand of fertilizers, acid phosphates, fertilizer materials or chemicals, which they desire to sell, either by themselves or their agents, together with the name and address of the manufacturer and also the guaranteed analysis thereof, stating the source from which the phosphoric acid, nitrogen and potash are derived. — *Tag Tax.* 10 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture, Atlanta, Ga.

HAWAII. — No fertilizer law.

IDAHO. — No fertilizer law.

ILLINOIS. — *Registration.* Every manufacturer, importer or party before selling any commercial fertilizer in the State shall file in the State

Board of Agriculture the name or trade mark under which each brand is sold, the name of the manufacturer, the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in available form, of potassium soluble in water, and of phosphorus in an available form (soluble or reverted) as well as the total phosphorus. — *License Fee.* $20 for each brand, payable annually, before May 1st. — *State Fertilizer Official.* Secretary, State Board of Agriculture, Springfield, Ill.

INDIANA. — *Registration.* Before offering for sale or selling any material for manurial purposes in Indiana, said material must be properly registered with the State Chemist and official labels secured. — *Tag License.* All packages of 200 pounds or fraction thereof, including sample bottles, must bear the State Chemist's official label. Labels to be furnished by State Chemist in lots of not less than 500, at $1.00 per hundred. — *State Fertilizer Official.* State Chemist, Agricultural Experiment Station, Lafayette, Ind.

IOWA. — *Registration.* Any one offering for sale or selling in the State of Iowa, any commercial fertilizer shall affix to every package, or furnish to the purchaser of the goods sold in bulk, a certificate naming the materials of which the fertilizer is made, the name or trade mark, name of manufacturer and chemical analysis. Certificate to be filed before May 1st with the Dairy and Food Commissioner. — *License Fee.* $20.00 per brand. — *State Fertilizer Official.* Dairy and Food Commissioner, Des Moines, Iowa.

KANSAS. — *Registration.* The manufacturer or seller of any brand of commercial fertilizer shall register with the Director of the Agricultural Experiment Station, before January 1st of each year, the name of each brand, together with a statement as to its guaranteed composition. — *Inspection Tax.* 25 cents per ton. — *State Fertilizer Official.* Dean of the Division of Agriculture, the Experiment Station, Manhattan, Kansas.

KENTUCKY. — *Registration.* Before any person or company shall sell any commercial fertilizer in the State of Kentucky, said person or company shall furnish annually, before December 31st, to the Kentucky Agricultural Experiment Station, a sealed quantity of each brand not less than a pound, accompanied by an affidavit stating the name and address of the manufacturer, the brand name, and the minimum percentage of the essential ingredients guaranteed in said fertilizer. — *Tag Tax.* 50 cents per ton. — *State Fertilizer Official.* Department of fertilizer, Kentucky Agricultural Experiment Station, Lexington, Ky.

LOUISIANA. — *Registration.* Manufacturers and dealers in any commercial fertilizer, before offering same for sale in the State, shall submit to the Commissioner of Agriculture and Immigration for inspection and analysis, fair samples of each brand, also the name of the brand, number of pounds to be contained in package for sale, name and address of manufacturer, and the guaranteed analysis of the ingredients. — *Inspection Fee.* 25 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture and Immigration, Baton Rouge, La.

MAINE. — *Registration.* Before manufacturing, selling, or distributing any commercial fertilizer in the State a certified statement shall be

filed with the Director of the Maine Experiment Station, showing the brand name, name and address of manufacturer, also the minimum percentage of nitrogen, phosphoric acid and potash in each brand. — *Fee.* A registration fee is assessed on any brand offered for sale in the State as follows: $ 10 for the nitrogen, $ 10 for the phosphoric acid and $ 5.00 for the potash contained in the fertilizer. — *State Fertilizer Official.* Chief of the Bureau of Inspection, Department of Agriculture, Augusta, Me.

MARYLAND. — *Registration.* All brands of fertilizers sold or offered for sale shall be registered with the State Chemist, also the name and address of manufacturer and a statement showing chemical analysis of each brand. At the close of the calendar year a statement shall be filed with the State Chemist, as to the total number of tons of fertilizer sold in the State. Inspection fees to be deducted from the tonnage tax at close of season. — *Inspection Fee.* $ 10.00 per brand. — *Tonnage Tax.* 10 cents per ton. — *State Fertilizer Official.* State Chemist, Maryland Agricultural College, College Park, Md.

MASSACHUSETTS. — *Registration.* No commercial fertilizer shall be offered for sale or sold in the State without a printed label showing the number of pounds in the package, brand name, address and name of manufacturer, and the minimum percentage of the ingredients. Registration to be made before January 1st. When the certified copy of the label has been filed and the analysis fee paid a certificate to this effect is to be issued.— *Analysis Fee.* $ 8.00 for the nitrogen, $ 8.00 for the phosphoric acid, and $ 8.00 for the potash contained in each brand of fertilizer. — *State Fertilizer Official.* Director of Massachusetts Experiment Station, Amherst, Mass.

MICHIGAN. — *Registration.* Before any commercial fertilizer is sold or offered for sale the manufacturer or importer shall file with the Secretary of State Board of Agriculture a certified copy of the analysis of each brand, a certificate showing the net weight of the contents of each package, the brand name and principal address of the manufacturer, minimum percentage of nitrogen, potash and phosphoric acid. He will also deposit with the Secretary a sealed glass jar containing not less than two pounds of each brand as a fair sample. — *License Fee.* $ 20 for each brand. — *State Fertilizer Official.* State Chemist, Michigan Agricultural College, East Lansing, Mich.

MINNESOTA. — No fertilizer law.

MISSISSIPPI. — *Registration.* All manufacturers, jobbers, and manipulators of commercial fertilizers and fertilizer materials who desire to sell in the State of Mississippi, will first file each season with the State Chemist and also with the Commissioner of Agriculture and Commerce, the name of each brand of fertilizer or fertilizer materials, the name and address of manufacturer, grade of fertilizer or fertilizer materials, and also the guaranteed analysis thereof, and the minimum percentage of the principal ingredients. — *Registration Fee.* $ 5.00 for each brand. — *Tag Tax.* 20 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture and Commerce, Jackson, Miss.

MISSOURI. — *Registration.* The Missouri fertilizer law requires every manufacturer or dealer to register with the Missouri Experiment Station, all brands of fertilizers offered for sale in Missouri, together with a guaranteed chemical composition of same. It provides further that the manufacturer shall affix to every package of fertilizer a printed tag signed by the Experiment Station, certifying to the fact of registration. — *Tax Tag.* 1-½ cents for each tag for packages weighing 100 pounds, and 3 cents for each tag for packages weighing more than 100 pounds. This is equivalent to a tax of 30 cents per ton. — *State Fertilizer Official.* Director of the College of Agriculture, Columbia, Mo.

MONTANA. — No fertilizer law.

NEBRASKA. — No fertilizer law.

NEVADA. — No fertilizer law.

NEW HAMPSHIRE. — *Registration.* Any manufacturer or person offering for sale commercial fertilizers in the State of New Hampshire shall file with the Secretary of the State Board of Agriculture a statement showing the brand name, name and address of manufacturer, location of factory, also chemical analysis stating the percentage of nitrogen, phosphoric acid and potash. Also, a glass jar containing not less than one pound of each brand accompanied by an affidavit that it is a fair sample. — *License Fee.* $ 10.00 for the phosphoric acid, $ 5.00 for the nitrogen, and $ 5.00 for the potash contained in each brand of fertilizer. The fee for a brand not to exceed $ 15.00. — *State Fertilizer Official.* Secretary of the State Board of Agriculture, Concord, N. H.

NEW JERSEY. — *Registration.* All corporations, firms, or persons, before selling or offering for sale any commercial fertilizer in the State of New Jersey, shall brand or attach to each bag or package a printed statement showing the number of pounds of fertilizer contained in a package, brand name, name and address of maufacturer, and the minimum percentage of the ingredients contained in each brand; the statements to be filed with the chemist of the New Jersey Agricultural Station, before November 1st of each year. — *Inspection Fee.* 15 cents per ton. — *State Fertilizer Official.* State Chemist, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

NEW MEXICO. — No fertilizer law.

NEW YORK. — *Registration.* No manufacturer, firm, association, or corporation shall offer for sale in the State of New York any commercial fertilizer or any materials to be used in the manufacture of fertilizer, the selling price of which exceeds $ 5.00 a ton, unless such commercial fertilizer or material to be used as a fertilizer shall be accompanied by a printed statement which shall show the number of pounds in a package, trade mark, name and principal address of manufacturer, and the minimum percentage of the nitrogen, available phosphoric acid, and potash. Statement to be filed before January 1st of the calendar year with the Commissioner of Agriculture. — *License Fee.* $ 20.00 for each brand. — *State Fertilizer Official.* Commissioner of Agriculture, Department of Agriculture, Albany, N. Y.

North Carolina. — *Registration.* All persons before selling commercial fertilizers or fertilizer materials shall brand or attach to each package the brand name of the fertilizer, the weight of the package, the name and address of the manufacturer, and the guaranteed analysis of the fertilizer giving the valuable constituents of the fertilizer and minimum percentages only. A copy of the brand or stamp shall be filed with the Commissioner of Agriculture. Fiscal year ends November 30th. — *Inspection Tax.* 20 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture, Raleigh, N. C.

North Dakota. — *Registration.* Every person who shall sell commercial fertilizer in the State of North Dakota, or material to be used in fertilizers, the selling price of which exceeds $ 5.00 per ton, shall stamp on or affix to the package a statement which contains the number of net pounds in the package, brand name, name and address of manufacturer, and a chemical composition of the fertilizer. Copy of this statement shall be filed with the North Dakota Agricultural Experiment Station. The fiscal year ends December 31st. — *License Fee.* $ 20.00 for each brand. — *State Fertilizer Official.* Food Commissioner, North Dakota Agricultural College, Agricultural College, North Dakota.

Ohio. — *Registration.* Any firm, manufacturer, or corporation, who manufactures, sells, or offers for sale commercial fertilizers in the State of Ohio, shall file with the Agricultural Commissioner a certified copy of a certificate showing the number of net pounds in each package, brand name, name and post office address of the manufacturer. The certificate shall also contain a chemical analysis which shall state the minimum percentages guaranteed of ammonia, potash soluble in water, and of phosphoric acid in available form. Fiscal year ends December 31st. — *License Fee.* $ 30.00 for each brand. — *State Fertilizer Official.* Bureau of Inspection, Division of Agriculture, Columbus, Ohio.

Oklahoma. — *Registration.* Any firm or corporation who shall sell in Oklahoma any commercial fertilizers, shall attach to every package a certificate stating the number of net pounds in package, name of the brand or trade mark, name of the manufacturer, the place of manufacture; also a chemical analysis stating only the percentage of total nitrogen or potash soluble in water or phosphoric acid in available form. A copy of this certificate must be filed with the Secretary of the Territorial Board of Agriculture. Fiscal year ends April 30th. — *License Fee.* $ 20.00 for each brand. — *State Fertilizer Official.* — Secretary of the State Board of Agriculture, Oklahoma City, Okla.

Oregon. — *Registration.* — Every package of commercial fertilizers or materials to be used for manurial purposes, the selling price of which exceeds $ 5.00 a ton, shall be accompanied by a label containing the brand name and trade mark, number of the net pounds contained in a package, name and address of the manufacturer. Also a chemical analysis stating the percentages claimed to be therein of total nitrogen, also specifying the form or forms and percentage amounts in which it is present; of phosphoric acid, stating percentages of soluble, reverted, insoluble and total;

of potash, stating the percentage soluble in distilled water. Statement shall be filed with Oregon Experiment Station annually during the month of December. — *License Fee.* $ 20.00 for each brand. — *State Fertilizer Official.* Chief Chemist, Oregon Agricultural Experiment Station, Corvallis, Oregon.

PENNSYLVANIA. — *Registration.* — Every manufacturer or importer of commercial fertilizer shall, on or before the first day of January of each year, before offering for sale in the State of Pennsylvania, file with the Secretary of Agriculture a statement of the names and number of brands of commercial fertilizers, showing the distinct trade name which they shall offer for sale during the ensuing year, and a copy of the analysis of each brand. This statement shall also include the name and address of the manufacturer, the net weight of the contents of proposed package, brand or trade name, and an analysis stating the percentage such fertilizer contains of nitrogen in an available form, of potash soluble in water, of soluble and reverted phosphoric acid, and insoluble phosphoric acid. The affidavit shall be filed before January 1st of each year, showing the amount of each brand of fertilizers having a distinct trade name, sold within the State during the preceding year. — *License Fee.* 100 tons or less, $ 15.00 per brand ; 100 to 500 tons, $ 20.00 per brand ; 500 tons or more, $ 30.00 per brand. — *State Fertilizer Official.* Clerk of Fertilizer Control, Department of Agriculture, Harrisburg, Pa.

RHODE ISLAND. — *Registration.* Before any commercial fertilizer is sold, importer, manufacturer, or party who cause it to be sold or offered for sale within the State of Rhode Island, shall file with the Board of Managers of the Rhode Island State College a certified copy of the label showing the number of net pounds in a package, the name or brand under which the fertilizer is sold, the name and address of the manufacturer, and a chemical analysis stating the percentages of ingredients in the brands. The certificate shall also be accompanied by a list of the names and addresses of the agents in this State, and a glass jar containing not less than one pound of fertilizer shall accompany the statement, said bottle to be accompanied by an affidavit that it is a fair average sample thereof. Fiscal year ends March 31st. — *Analysis Fee.* $ 8.00 for each of the fertilizer ingredients contained, or claimed to exist in each brand registered. — *State Fertilizer Official.* State Chemist, Agricultural Experiment Station, Kingston, Rhode Island.

SOUTH CAROLINA. — *Registration.* Every person or corporation engaged in the manufacture and sale of fertilizers, or commercial manures, or cottonseed meal, in the State of South Carolina, shall on the first day of November of each year, file with the Board of Trustees of the Clemson Agricultural College, a true and correct copy of a printed label required, said label to contain the name, location and trade mark of the manufacturer, the number of pounds weight in each package, also the chemical composition of the contents of said package, and a minimum percentage only of any of the following ingredients claimed to be present, namely : available phosphoric acid, nitrogen, and its equivalent, ammonia, and potash soluble

in water. — *Inspection Tax.* 25 cents per ton. — *State Fertilizer Official.* Board of Fertilizer Control, Clemson College, South Carolina.

South Dakota. — No fertilizer law. There is, however, a general statute to the effect that an article must be what it is guaranteed to be. — *State Fertilizer Official.* Agricultural Experiment Station, Brookings, South Dakota.

Tennessee. — *Registration.* — All manufacturers, jobbers, and manipulators, of fertilizers or fertilizer materials used in the manufacture of same, who desire to sell in the State of Tennessee, shall file with the Commissioner of Agriculture, the name of each brand of commercial fertilizer, acid phosphates, fertilizer material or chemicals, together with the name and address of the manufacturer or manipulator, also the guaranteed analysis thereof, stating the sources from which the nitrogen, phosphoric acid and potash are derived. — *Inspection Tax.* 50 cents per ton. — *State Fertilizer Official.* Commissioner of Agriculture, Nashville, Tenn.

Texas. — *Registration.* All corporations, firms, or persons, before selling or offering for sale any commercial fertilizer for use in the State, shall brand or attach to each package a statement showing the brand or name of the fertilizer, the net weight of the contents of the package, name and address of the manufacturer, or person registering such fertilizer, and the minimum percentage guaranteed to be present of available phosphoric acid, of nitrogen and of potash soluble in distilled water. Fiscal year ends August 31st. All firms before selling fertilizers in the State shall annually file with the State Chemist of Texas Agricultural Experiment Station a certified statement of each brand. — *Inspection Tax.* 25 cents per ton. — *State Fertilizers Official.* State Chemist, Agricultural and Mechanical College of Texas, College Station, Texas.

Utah. — No fertilizer law.

Vermont. — *Registration.* Every lot of commercial fertilizers sold or offered for sale, the retail price of which is $10.00 or more a ton, shall be accompanied by a printed statement, certifying the number of net pounds of the fertilizer in a package, the name, brand or trade mark under which the fertilizer is sold, the name and address of the manufacturer, and a chemical analysis stating the minimum percentage of nitrogen, potash soluble in water, and available and total phosphoric acid. The fiscal year ends December 31st. — *License Fee.* $20.00 for each brand. — *State Fertilizer Official.* Director of the Vermont Agricultural Experiment Station, Burlington, Vt.

Virginia. — *Registration.* All manufacturers, dealers or agents who may desire to sell or offer for sale in the State of Virginia, any fertilizer or fertilizer materials, shall first file with the Commissioner of Agriculture and Immigration of the State, upon forms furnished by said Commissioner, the name of each brand of fertilizer or fertilizer material, together with the name and address of the manufacturer, also the guaranteed analysis thereof, stating the minimum percentage of available phosphoric acid and the nitrogen and potash. — *Brand Tax.* $5.00 per ton. — *Tonnage Tax.* 15 cents

per ton. — *State Fertilizer Official.* Commissioner of Agriculture and Immigration, Richmond, Va.

WASHINGTON. — *Registration.* All commercial fertilizer sold or offered for sale in the State of Washington, the price of which is $10.00 or more per ton, shall be subjected to annual inspection by the proper sources at the Experiment Station, and all such fertilizers shall be accompanied by a printed label showing the number of pounds in the package, name of brand, name and address of manufacturer, and the guaranteed percentage of composition. A certified copy of this statement shall be filed with the State Chemist. — *Analysis Fee.* $ 6.00 for each of the fertilizer ingredients claimed to exist in each brand registered. — *State Fertilizer Official.* Commissioner of Agriculture, Pullman, Wash.

WEST VIRGINIA. — *Registration.* Before any fertilizer is sold or offered for sale in this State, the manufacturer, importer or party who causes it to be sold, shall file with the Director of the Experiment Station a statement showing the number of net pounds of fertilizer in each package, name of brand or trade mark under which the fertilizer is sold, name and address of manufacturer, and also stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water and phosphoric acid available in distilled water and reverted, as well as the total phosphoric acid and the materials from which the constituents are derived. — *Registration Fee.* 40 cents per ton. — *State Fertilizer Official.* Department of Chemistry, West Virginia University, Morgantown, W. Va.

WISCONSIN. — *Registration.* Every person who sells in the State of Wisconsin any fertilizer or fertilizer material, the price of which exceeds $ 10.00 a ton, shall affix to every package a statement showing the number of net pounds therein, the trade mark under which the fertilizer is sold, the name and address of manufacturer, and the percentage of nitrogen in available form, of potash soluble in water, and available phosphoric acid soluble and reverted, as well as total phosphoric acid. A form of the label shall be filed with the Director of the Agricultural Experiment Station, University of Wisconsin, in the month of December of each year. *License Fee.* $ 25.00 for each brand. — *State Fertilizer Official.* Inspection Division, College of Agriculture, University of Wisconsin, Madison, Wis.

WYOMING. — No fertilizer law.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

134 – **Peruvian Agricultural Products** (1). — *Peru To-day*, Vol. VI, Nos. 3, 4 and 5. pp. 97-101, 148-159. Lima, July-August-September, 1914.

Cotton is grown throughout the coastal zone. During the past two or three years the area under this crop has considerably extended, and many sugar estates are planting a fair quantity of cotton. The quality also has improved very much owing to the introduction of modern machinery. The coast of Peru is admirably adapted to the growth of cotton, for the mildness of the climate and the absence of storms and heavy rains reduce the work of cultivation; thus the cost of production is 2 or 3 cents a pound less than in the United States. Besides, the yield per unit of area is greater in

(1) See also *B.* May 1913, No 449. (*Ed*).

Peru than in any other part of the world. Upland cotton (*Gossypium hirsutum*) gives from 553 to 968 lbs. per acre in the Cañete Valley and a maximum of 1384 lbs. has been reached in the Lambaveque Valley. Sea Island gives an average of 447 lbs., Mit Afifi up to 550 lbs. on the coast and 830 lbs. in the upper valley of the Pativilca. The Peruvian average production is 484.4 lbs.; the Egyptian 390.4 lbs.; the United Sates 308 lbs. or less.

Sugarcane occupies between 75 000 and 100 000 acres of land. During the past two years, 1912-1913, more than £1 500 000 have been invested in machinery installations. In 1912, 192 754 metric tons of sugar were produced (of which 149 188 metric tons were exported) and over 1 980 000 gallons of alcohol from sugarcane. The 1913 crop was about the same. In Peru the production runs as high as 40 tons per acre, while in Cuba it is approximately 22 tons per acre. Sugar is produced in Peru at a cost of from £5 to £6 per ton, against £14 per ton in Louisiana, £9 in the West Indies and £12 to £14 in Hawaii.

Rubber (1). — Wild rubber is chiefly obtained from *Hevea brasiliensis* which grows usually to a height of 60 to 75 ft. in the lower lands up to an elevation of 300 feet. *Castilloa* is also found in Peru at higher altitudes and provides the *caucho* of trade. Along the Halluaga river and at other points in the eastern Provinces extensive rubber plantations have been laid out. The rubber output in 1913 was 2781 metric tons, valued at approximately £816 000. The highest previous production was 3193 metric tons in 1912, valued at £1 380 000.

Coffee. — Several kinds of coffee are grown in Peru, all being of superior quality; its cultivation has reached the largest development in the Montaña and Sierra districts. Usually 200 trees are planted to the acre and after the third year the yield from each coffee plant is more than one pound in weight.

Vineyards. — Wine growing has been practised for centuries; of late years the vineyards have extended considerably, especially in the Ica Valley, where they cover about one-fifth of the cultivated area (namely about 8000 acres) in the Moquegua valley, the vineyards of which are considered to produce the best Peruvian wines, and in the neighbourhood of Lima and Arequipa. In 1907 some experimental vineyards with over 10 000 vines were planted in the Moquegua valleys.

Maize is grown extensively, the maize of Cuzco being considered the most productive as well as the largest and most vigorous of all the known varieties.

Rice is grown chiefly in the Department of Lambayeque and the district of Pacasmayo.

Barley and *wheat* are grown mainly on the upland plateaux. The Peruvian Corporation has been carrying out successful series of experiments in the vast arid upland Lake Titicaca region with cereals and grasses brought from the high altitudes of China, India, Tibet and Abyssinia and from the

(1) See also *B.* May 1913, No. 518. (*Ed*).

dry plains of Persia, Siberia, Smyrna and Tripoli. Experiments are also being made in the Junin highlands with Siberian alfalfa.

Lima beans native in Peru, grow to perfection and yield an average of 1700 lbs. per acre.

Tobacco has been grown in Peru from remote times. Tumbes, Jaen, Hunacalamba, Jeveros are the chief sources of the supply of the leaf.

Coca. — The production of coca has decreased considerably in recent years. The largest area devoted to this industry is in southern Peru around Cuzco. In 1913, 7187 lbs. of cocaine worth £28 000 were manufactured.

Tea. — In the vicinity of Cuzco experiments are being made with the production of tea, and leaves of excellent quality have been obtained.

Fruits and vegetables. — All the fruits of the tropics and of the temperate zone can be grown to perfection in Peru. The olive was imported into Peru during the time of the viceroyalty; it is, however, only within recent years that it has assumed importance, especially in the coast Province of Camanà, Department of Arequipa, and in Ilo and Moquegua. In the latter department are to be found the best varieties introduced from Seville, Spain.

Forests. — Their utilisation, in spite of their wealth, is at present prevented by the transportation problem, but will no doubt be solved in time.

Stock raising. — In Peru the raising of live stock is extensively practised and especially in the Departments of Cajamarca, Junin, Ayacucho and Puno and in the districts of Acomayo, Chumbivilcas, Canas and Anta. In these districts the estates are large. The Peruvian cattle, which it is believed originate from the stock imported from Spain, are of medium size, strong for work in the field, but rather inferior for beef or dairy purposes. In order to improve the stock several choice breeds have been introduced with success, especially the Shorthorn and Brown Swiss The exportation of hides and skins and the tanning industry are of growing importance. The goat and kid skins of Piura are in great demand.

The wool product in 1913 amounted to 4710 metric tons, valued at £649 806. Recently Tierra del Fuego and Patagonian sheep have been introduced for cross breeding. A British enterprise conducts a sheep ranch at Atocsayco, where the yield has been as much as 6 ½ pounds per head. Besides sheep's wool, Peru produces that of the llama, the alpaca (1) and the vicuña. The female alpacas yield from 5 ½ to 6 ½ lbs. of wool and the males from 6 ½ to 8 ¾. Pigs are reared chiefly in the Barranca, Supe, Huacho and Chancay valleys, where they are fattened with maize, lucerne, sweet potatoes and barley. The principal object of breeding pigs is the production of lard, which amounts to over 2 200 000 lbs. per annum. This quantity, however, is insufficient to meet local demands.

The following are the most important items of agricultural produce exported during the year 1913 :

(1) See also *B.* April 1912, No. 685. (*Ed*).

	metric tons	£
Cotton	56 162	1 564 844
Sugar	142 902	1 412 665
Rubber	2 781	815 998
Wool	4 711	649 806
Skins and hides	3 727	200 924
Guano	37 530	150 120
Panama hats	—	118 735
Rice	3 410	78 226
Cattle	—	39 705

135 – **Agriculture in Malaya in 1913.** — LEWTON-BRAIN, L. (Director of Agriculture, F. M. S.). — *Department of Agriculture, Federated Malay States, Bulletin* No. 20, pp. 45. Kuala Lumpur, September 1914.

At the close of the year 1913 the total area planted in rubber in the Federated Malay States amounted to 433 324 acres. In the Straits Settlements the total area under rubber was 113 316 acres, and in the non-federated States 163 905. The total area under rubber, therefore, in Malaya amounted to 708 545 acres, of which only 213 419 acres were in bearing at the end of the year and only 165 566 throughout. The average yield is over 290 lbs. per acre. The output for the year 1914 for Malaya is estimated at about 36 000 tons.

In all these figures, as in the following ones dealing with the yield, only plantations of 100 acres in extent are taken into account.

The rubber acreage producing in the Federated Malay States is returned at 164 390 acres. The average yield per acre was about 275 lbs., but if only the area in full bearing is considered it can be estimated safely at 400 lbs. per acre.

The rubber output in 1913 is returned at 20 226 tons, with an increase of 42 per cent over that of the previous year, and is over one half the world's total of plantation rubber as given by Messrs. LEWIS and PEAT, *viz.* 47 000 tons.

The total estate production of Malaya for 1913 is returned at 28 214 tons, or 30 per cent over last year. At the end of 1912 the number of labourers employed on estates in the Federated Malay States is given as 201 207; their wages ranged from 25 cents (*7d*) to $ 1 (*2s 4d*).

The general view now is that not more than 100 trees should originally be planted to the acre and that eventually about 40 or 50 to the acre should be left. Of the total of 433 324 acres under rubber in the Federated Malay States only some 10 891 acres are interplanted with catch crops, and of this coffee occupies about 4906 acres. In the Straits Settlements, the area is 9164 acres, or about 8 per cent of the total under rubber. Indigo, which was considered as a possible catch crop, was tried at Kuala Lumpur on hill land, and on the alluvial soils at Telok Anson, but has not proved a success.

Cover crops that are not revenue-producing are also very little in favour among the planters except on the steepest hillsides, and this notwithstanding the fact that some of these cover plants have given very good results,

such as the horse gram (*Dolichos biflorus*), the Sarawak bean (*D. hosei*) (1), Passion flower (*Passiflora fœtida*) and the sweet potato, the latter particularly in damp localities.

As for the question whether tapping should be done every day or on alternate days, the writer's experiments show consistently that for the same amount of bark removed, the total yield is greater where every day tapping is practised, but that the yield per tapping is greater where this is done on alternate days. Consequently if the cost of production per lb. of rubber is alone to be considered the alternate day system will be preferred. But the production per acre must also be considered and the reduction in cost per lb. of rubber must not be too much insisted on, so that if by tapping every day a profit on the extra cost of tapping is made, every day tapping should be adopted.

Of the insect pests of rubber reported, *Xyleborus parvulus* is the only one that requires mention and among fungus diseases only the pink disease caused by *Corticium salmonicolor*.

The area under coconuts is estimated at 174 234 acres, most of which is on the west coast and almost confined to the alluvial coast plain on that side of the country. Upwards of three-quarters of the quantity of coconuts grown are on small holdings under 100 acres in extent. In 1913, 9264 tons of copra were exported.

In some estates coffee is grown with some success as an intercrop with coconuts. Liberian coffee can quite well be grown with coconuts and at present probably pays better than the Robusta.

The most serious pest of coconuts during the year has been the rat. Fungus diseases have been comparatively rare. A new disease of young coconuts was found, caused by a species of *Helminthosporium* which can be eradicated by cutting out the diseased leaves and spraying with Bordeaux mixture.

Paddy occupied in 1912-13 in the Federated Malay States 125 873 acres. The yield amounted to 3 143 542 bushels. In 1913-14 the area under rice was 123 828 acres.

Coffee was grown in 1913 on 7695 acres, the area diminishing in comparison with previous years, owing to the low prices of Robusta coffee. It is grown mostly in Selangor.

In the Experimental Plantations at Kuala Lumpur, Batu Tiga and Gunong Augsi, the following plants have been successfully grown or are still under experiment:

Castilloa elastica, which was planted at Gunong Augsi at an elevation of 1200 feet and has shown remarkably good growth; the African oil palm (*Elaeis guineensis*), Manila hemp (*Musa textilis*), Sisal hemp (*Agave rigida* var. *sisalana*), *Furcraea* sp.; *Sansevieria* sp. and other textiles; ipecacuanha, which thrives well; *Hedychium coronarium* as paper material; *Cinchona succirubra* and *C. ledgeriana*; Brazil nuts (*Bertholletia excelsa*); several species of coffee; camphor; among fruit trees: *Terminalia edulis*,

(1) See *B.* Oct. 1914, No 906. (*Ed.*).

Artocarpus odoratissima, several bananas, *Anonia cherimolia*, *Spondias purpurea*, *Hibiscus sabdariffa*, which was introduced from the Philippines and is satisfactorily grown at Kuala Lumpur, and various species of *Indigofera*.

136 – **Alum in Foods.** — *Bulletin of the United States Department of Agriculture*, No. 103, pp. 7. Washington, April 29, 1914. RURAL HYGIENE.

The term " small quantity " is applied to such an amount as may be ingested daily in the normal use of biscuits, pastry, or other articles leavened with baking powder containing alum, and which corresponds to 25 to 75 milligrams of aluminium. By the term " large quantity " is understood such an amount of aluminium as would be ingested only under unusual conditions and which may reach 150 to 200 milligrams. The effects of amounts up to and exceeding 1000 milligrams of aluminium having also been studied, the Referee Board of Consulting Scientific Experts, in answer to questions put to it by the United States Department of Agriculture, have drawn up a report stating that :

Aluminium compounds when used in the form of baking powders in foods have not been found to affect injuriously the nutritive value of such foods.

Aluminium compounds in small quantities, up to 150 mgms. daily, have not been found poisonous or injurious to health. In quantities up to 200 mgms. per day they may provoke mild catharsis.

Large quantities of aluminium usually provoke catharsis, owing to the sodium sulphate which results from the reaction during digestion.

Aluminium itself has not been found to exert any deleterious action injurious to health, beyond the production of occasional colic when very large amounts have been ingested.

When aluminium compounds are mixed or packed with a food the quality or strength of said food has not been found to be injuriously affected.

In short the Board conclude that alum baking powders are no more harmful than any other baking powders, but that it is wise to be moderate in the use of foods that are leavened with them.

137 – **Plants, Including Fungi, Poisonous or otherwise Injurious to Man in Australia.** — BURTON, J. CLELAND (Principal Government Microbiologist, N. S. W.) in *The Agricultural Gazette of Tasmania*, Vol. XXII, No. 9. pp. 361-367; No. 10, pp. 401-403. Hobart, September and October 1914.

This paper is a review of various references to injuries to man caused by plants recorded in Australia.

Euphorbiaceae. — *Euphorbia drummondii* Boiss. The seeds seem to have cathartic properties, and the plant is stated to be injurious to stock. It has been observed, however, that pigeons eat its fruit with impunity.

Ricinus communis (Castor Oil Plant). This is a common, introduced plant in Australia, growing in many waste places. Several cases of poisoning by the seeds have been recorded.

Anacardiaceae. — *Anacardium occidentale* (Cachew Nut). Several of these trees exist in Queensland. There are many varieties with varying

properties and uses, some of them poisonous; but two are edible, a red and a yellow variety.

Leguminosae. — *Castanospermum australe.* The poisonous properties of this plant, the Moreton Bay chestnut, are well known as regards animals. The pods contain saponin, which may be got rid of by running water.

Rosaceae. — *Prunus amygdalus* var. *amara* (Bitter Almond) the seeds of which are poisonous.

Myrtaceae. — *Rhodomyrtus macrocarpa.* It is stated that if the berries are eaten when infested by a fungus, *Gloeosporium,* they produce, in certain subjects, paralysis of the optic nerve and sudden blindness, but that when they are not so affected they are harmless. However, the blacks eat the fruit unreservedly, as do some whites.

Eucalyptus spp. Fatal cases of poisoning from over-doses of Eucalyptus oil have been recorded.

Umbelliferae. — *Conium maculatum.*

Cucurbitaceae. — Wild melons with poisonous fruits, which probably contain an alkaloid. It has been stated also that there had been considerable mortality amongst horses in one locality in consequence of having eaten wild melons.

Convolvulaceae. — Giant convolvulus. It causes poisoning with symptoms resembling those caused by belladonna poisoning and yielding to the same remedies.

Solanaceae. — *Duranta plumieri,* the berries of which are poisonous.

Anthocercis littorea, a native plant which causes poisoning with the same symptoms as those due to belladonna and which yields to the same treatment.

Datura stramonium (Thorn Apple). This introduced plant is common in waste places in Australia.

Atropa belladonna.

Cycadeae. — Species of *Macrogamia.* The untreated nuts are poisonous in man and in cattle, causing a form of paresis. The poisonous principle, which is said to be oxalic acid and a crystalline substance probably an alkaloid, is removed by maceration.

Cycas media has caused incipient poisoning in man and has feen fatal to pigs, which however, eat the nuts heartily.

Zamia spiralis, bears poisonous nuts.

Gramineae. — *Lolium* spp. probably, *L. perenne.* The presence of seeds of *L. temulentum* is well known as a cause of nervous symptoms.

Fungi. — In the State of Victoria the poisonous fly agaric (*Amanita muscaria*) is recorded, as well as other species of *Amanita,* probably including poisonous kinds.

One case of poisoning was believed to be due to *Agaricus campestris* growing on some foul medium or being itself attacked by some poisonous parasite.

138 – **Work of the Experimental Station for Sugarcane at Escada in the State of Pernambuco, Brazil, from October to December 1913.** — *Ministerio da Agricultura Industria e Commercio, Boletim da Estação Experimental de Canna de Assucar, Escada, Estado de Pernambuco*; Year II, No. 1, pp. 146 + table and figs. January-June 1914.

The Bulletin contains: — the report of the Director on the work carried out at the Experimental Station from October to December 1913; a study on the character of the rains in 1913; a description of the method adopted in the Chemical Laboratory of the Station for the analysis of canes; a report of the tour of inspection in the Pernambuco country for studying the cultivation of coconuts and the conditions adverse thereto; a description of the methods of practical verification, scientific examination and chemical control of the machinery for crushing the cane in connection with a possible imbibition of the bagasse; preliminary notices on the work commenced at the Station for obtaining new varieties of cane from seed; considerations on the choice of slips for planting; instructions for the transmission of insect specimens to the Station; statistical tables showing the commercial movement of sugars in various parts of the world.

The average yield of cane in the State of Pernambuco is stated by the Director to be 48 tons per acre with 13 per cent of extractible sugar, *i. e.* 7000 lbs. of sugar per acre, against 13 800 lbs. in Java. The cost of producing 1 lb. of sugar in Pernambuco is estimated at 1.35*d* (1), against 0.75*d* in Java, 0.8*d* in Cuba, and 1.25*d* in Hawaii.

The studies on the character of the rains in 1913 include others on the quantity of water necessary for the proper growth of the cane in the State of Pernambuco. It was found that for 100 acres of cane, the daily evaporation averages 86 430 cu. ft. of water, equivalent to 0.24 in. to be supplied by rain or irrigation, or 7.2 in per month. The writer, Dr. Luiz de Waal, gives several tables of the rainfall for the State in the five years 1909-13; they show that on the average there should be sufficient rain from March to August, but less than sufficient in other months. The five years gave an average of 156 days of rain in the year and a monthly rainfall of 4.32 in.

In his report on the inspection tour, Dr. Pedro Corrêa notes that well-kept coconuts in the State of Pernambuco are free from serious disease, seeing that as a rule the parasitic insects called " besonzo ", the commonest of which is *Oryctes rhinoceros*, only attack weak and badly kept trees. He accordingly insists on the necessity of manuring the trees and indicates the good results that have been obtained by manuring with seaweed (sargassum).

Dr. Luiz de Waal notes that the cane called Cayanna, once preferred to all others and considered excellent but afterwards degenerating, is of Brazilian origin; he has therefore, side by side with his work of hybridisation and selection, undertaken attempts to regenerate the cane from seed in the hope that it will thus re-acquire its former good qualities and lose those that are objectionable.

(1) Taking the milreis at 15*d*. (*Ed.*)

As to the slips or cuttings of the cane intended for planting, he advises the rejection of canes, which, although they may be richer in sugar, are deficient in other substances necessary for the sprouting and nourishment of the young plant in the first year of its growth ; instead, the " flag " should be chosen, that is the top of the cane down to the first eye covered by hard epidermis : such a cutting generally contains three eyes, but may have five or six.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

139 – **The Non-Existence of Magnesium Carbonate in Humid Soils.** — Mac Intire, W. H.; Willis, L. G.; and Hardy, J. I., in *Agricultural Experiment Station of the University of Tennessee, Bulletin* No. 107, pp. 151-202. Knoxville, Tennessee, June 1914.

A long series of experiments was made on the behaviour of compounds of calcium and magnesium in the soil.

It was found that very heavy dressings of precipitated magnesium carbonate (equivalent to 8 tons of calcium carbonate per acre in excess of the " lime-requirement " as shown by the Veitch method) were completely decomposed after 8 weeks in moist soil under conditions precluding leaching ; in the case of equivalent quantities of precipitated calcium carbonate a large proportion of the CO_2 added was still determinable after 8 weeks.

Nine months after applications of similar amounts of ground limestone and ground dolomite, it was found that, while about three-quarters of the limestone added was still present as carbonate, less than half of the carbonate from the dolomite remained, although the limestone was 1.62 times as soluble as the dolomite in carbonated water.

In a laboratory experiment, it was found that an alkaline loam soil caused appreciable decomposition of precipitated magnesium carbonate during one night.

The writers can find no certain reference to the occurrence of magnesium as carbonate in soils, and they believe that, at any rate in moist mineral soils, magnesium carbonate does not exist and is rapidly decomposed when added.

Laboratory experiments to determine the agents causing decomposition, showed that precipitated magnesium carbonate was decomposed on moist contact with sand (coarse and fine), clay, kaolin and silt, both with and without the presence of precipitated calcium carbonate ; even soils strongly alkaline from excess of calcium carbonate can effect this decomposition.

Finally it was found that pure silica (hydrated and dehydrated) evolved carbon dioxide from precipitated carbonates of calcium and magnesium, or from dolomite, in presence of moisture at room temperatures ; the silicic acid radicle replaces the carbon dioxide, with formation of magnesium silicate.

Actual loss of magnesium from soils may take place owing to hydrolysation of magnesium silicate, which is shown to take place to an appreciable extent in carbonated water; the magnesium bicarbonate so formed is easily leached out. It should be noted that this action takes place more readily with calcium silicate than with magnesium silicate.

The toxicity usually attributed to magnesian lime was shown not to be due to the persistence of causticity, as magnesia was converted to carbonate in soils more readily than lime. In experiments with wheat and tall oat-grass, it was shown that toxic effects resulting from heavy dressings of precipitated magnesium carbonate were due to finely divided and extensively diffused magnesium silicate.

140 – **Soil Acidity and Methods for its Detection.** — HARRIS, J. E. (Division of Chemistry, Michigan Experiment Station) in *Science*, Vol. XL, No. 1031, pp. 491-493. New York, October 1914.

Owing to the colloidal nature of the acids of the soil, the only sure way to determine the lime requirement of an acid soil is to use the same material in the test as is used in the field for correcting the acidity. Methods which involve the estimation of the acid liberated by treating the soil with salts such as sodium or calcium chloride and zinc sulphide (1) are liable to error, since the amounts of the different ions absorbed by the acid colloids vary with the character of the soil and it is not possible to determine the equivalent amounts of calcium required. The methods of VEITCH and SÜCHTING are therefore considered to be most suitable for the purpose. As to the qualitative methods for the detection of soil acidity, it has been found that not all kinds of litmus paper are suitable. In experiments at the Michigan Agricultural Experiment Station, Kahlbaum's litmus paper has been found to be the only one not so thoroughly saturated with alkali as to make it unsuitable for this purpose. In fact it is so sensitive that only a few moments' contact with the soil particles is necessary to obtain a very distinct coloration.

141 – **Causes of the Sterility of Certain Soils in the Kankakee Marsh Region, Indiana.** — ABBOTS, J. B.; CONNER, S. D.; SMALLEY, H. R. (Department of Soils and Crops), in *Purdue University, Agricultural Experiment Station, Bulletin* No. 160, Vol. XVII, pp. 329-373. Lafayette, Indiana.

During the latter part of the glacial period, the region immediately south of the Valparaiso moraine, in the State of Indiana, seems to have been occupied by an extensive glacial lake, which geologists know as Lake Kankakee; the water subsequently drained away, leaving a vast marshy plain. This region embraces portions of Lake, Porter and La Porte counties, the greater part of Newton, Jasper, Pulaski, and Starke counties and portions of Benton, White, Cass, Fulton, Marshall and St. Joseph counties. It consists of peats, peaty sand, and dark sandy loams with some admixture of clay and silt, with frequent sand ridges and mounds. The peaty soils and dark sandy loams are rich in organic matter and nitrogen and

(1) See *B.* Oct. 1914, No. 877, (*Ed.*).

generally well supplied with available phosphoric acid, but almost always very deficient in available potash.

In this region some unproductive areas exist, one of which is about 30 square miles in extent; none of the cultivated crops thrive upon it, even after thorough drainage and liberal manuring.

Chemical analyses show these unproductive soils to be fairly well supplied with plant food, but excessively acid. Notwithstanding the excessive acidity these soils have been found to contain large amounts of nitrate nitrogen during the growing season.

Analyses of cold water extracts from one of these unproductive soils (that of the Wanatah experiment field) show that the nitrate, in part at least, is combined with aluminium.

Application of pulverised limestone has been found to reduce the acidity, to replace aluminium with calcium in the soil solution and to render the soil productive, but does not seem to have greatly accelerated the already rapid rate of nitrification.

It is evident that some element in these soils other than calcium or magnesium acts as a salifiable base capable of supporting nitrification, and the composition of the water extract points strongly to aluminium.

Very dilute solutions of aluminium nitrate are toxic to maize seedlings in water culture in the presence of mineral nutrients. The toxicity of aluminium nitrate was found to be approximately equal to that of nitric acid of the same normality.

Cold-water extracts of the unproductive soil show approximately the same toxicity as aluminium nitrate containing the same amounts of aluminium and approximately the same amounts of mineral nutrients.

The extreme toxicity of aluminium nitrate in water cultures even in the presence of nutrients, together with the presence of large amounts of water-soluble nitrate and aluminium in the soil, leads to the conclusion that soluble salts of aluminium, or more fundamentally the lack of basicity which permits them to exist, are largely responsible for the unproductiveness of the soil in question.

The toxicity in nutrient solution of aluminium nitrate and of soil extract is overcome by addition to the solution of various compounds (pricipitated carbonate of lime, di-calcic phosphate, sodium hydroxide, magnesium oxide, and tricalcic phosphate) which possess the common property of precipitating the aluminium and at the same time forming non-toxic salts with its acid radical.

It is suggested that the toxicity of aluminium nitrate may be due to the acid radical. Aluminium nitrate is more or less hydrolyzed in solution, and the acid radical is taken into the plant cells by osmosis, while the colloidal aluminium hydroxide is not.

The compounds which overcome the toxicity of aluminium nitrate and of soil extract in water culture also render the soil productive when applied to it in sufficient amounts.

Application of pulverised limestone or slaked lime at the rate of two to four tons per acre, supplemented by fertilisation with phosphates and

potash, has proved effective in field trials on a large scale and is recommended as a practical remedial treatment for rendering this type of soil productive.

142 – **The Origin of Vanillin in Soils.** — SULLIVAN, M. X. (Bureau of Soils, U. S. Dep. of Agr.) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 11, pp. 919-921. Easton, Pa., November 1914.

Vanillin was found in wheat seedlings in quantities up to about 15 parts per million; it was also found in many other plants either in the free condition or combined in such a form that it was liberated by hydrolysis; traces were likewise found in the water in which wheat seedlings had grown, so that it would appear that its presence in soil is due partly to derivation from vegetable debris and partly to direct excretion of growing plants.

143 – **Antagonism between Anions as related to Nitrogen Transformation in Soils** (1). — LIPMAN, C. B., in *The Plant World*, Vol. 17, No. 10, pp. 295-305. Tucson, Arizona, October 1914.

It has previously been shown (*Botanical Gazette*, (Vols. 48 and 49) that the kations of salts in solution exert toxic and antagonistic actions on the rate of ammonification of certain organisms, but some doubt has existed as to similar effects being exerted by the anions. These experiments were carried out to test this point and in order that they should have a more practical bearing, the salts occurring in alkali soils were chosen, *viz.* the chloride, sulphate and carbonate of sodium.

Solutions of these salts were tested for their effects on both ammonification and nitrification of soil organisms.

The method employed in the ammonification experiments was as follows: to 100-gram portions of a light soil of good ammonifying and nitrifying power placed in tumblers, were added 2 gms. of dried blood and the different salts in the required proportions. Enough sterile distilled water was added to make optimum moisture conditions and the mixture stirred. The tumbler was covered with a Petri dish cover and allowed to incubate for a week at 28° to 30° C. It was then distilled with magnesia and the ammonia measured against standard acid. The salt additions were made on the basis of their toxicities, which were determined in investigations described elsewhere (*Centralblatt für Bakteriologie*, Vols. 32, 33 and 35). All determinations were made in duplicate.

The results obtained showed that a marked antagonism exists between each of the salts Na_2Co_3, NaCl and Na_2So_4, not only in the case where one of the salts is a direct stimulant to ammonification as is Na_2Co_3, but also between two definitely toxic salts like NaCl and Na_2So_4.

In the nitrification experiments reciprocal series were made in all cases. In other respects the cultures were prepared like those in the ammonification series except that 1 % of dried blood instead of 2 % was used.

The results obtained showed that when sodium chloride was present in a toxic quantity of 0.2 % the nitrification was reduced by more than one half that of the normal soil. The addition of quantities of sodium sulphate

(1) See also *B.* Jan. 1914, No. 13 and *B.* Aug. 1914, No. 717. (*Ed.*).

from 0.05 % to 0.2% did not depress the rate of nitrification, but increased it beyond that of the normal soil, though the total alkali content of the soil was doubled. Further the addition of 0.05 % of sodium carbonate depresses nitrification to about 75 % below the normal. When, however, varying amounts of sodium sulphate are added up to about 0.5 % concentration, the nitrification is increased beyond that of the normal.

Still more remarkable results were obtained in the case of sodium carbonate and sodium chloride. Thus, 0.2 % of NaCl alone depresses the normal nitrifying power of the soil by considerably more than 50 % and 0.05 % of Na_2CO_3 alone depresses it by about 75 %. Yet when the two are added together the nitrifying power is increased by more than 25 % above that of the normal. Also, amounts of Na_2CO_3 two or three times as large as that which alone depresses nitrification by about 75 % can be made absolutely innocuous and even allow of a stimulating effect on nitrification, if 0.2 % NaCl is added to them.

Similar results have also been obtained with regard to the growth of the higher plants.

These results therefore testify: 1) to the general nature of Loeb's conception of physiologically balanced solutions, 2) to the relatively new or obscure fact that anions are as effective in antagonism between salts as kations, and 3) to the promising probability of employing the principle of salt antagonisms as a formidable weapon in the solution of alkali problems in soil management, as well as in other problems of practical value which are related to the physiology of plants.

OPENING UP LAND FOR CULTIVATION

144 – **Natural Fixation of Sands by Vegetation in the Region of the Caspian Sea.** — PALEZKII, V., in *Lesnoi Journal* (*Journal of Forestry*), Year XLIV, No. 5, pp. 875-888. Petrograd, 1914.

In studying the fixation of the sands in the Caspian region, the writer distinguishes eight stages between the bare sands and the steppe, extending over 80 to 150 years. Under natural conditions the passage from the first to the fifth stage requires 30 to 40 years ; with the assistance of man 15 to 20 years. It is possible that in other regions the number of the stages and their duration may be different. What is important to establish is the succession of the types of plants characteristic of the successive stages. The writer reviews them for the region in question.

The cultivator must be guided by the fixing of sands as carried out by nature ; he will thus avoid the excessive expense of preparing artificially the conditions of soil that are indispensable to a plant which does not grow spontaneously in any given stage. These consideration are very important in the work of fixing the sands of the Caspian, of Turkestan and of Astrakhan.

Along the Asiatic railway a new method of fixing the sand is employed ; it consists essentially in sowing and spreading only those plants which grow naturally in any given stage, but which for some special reason are rare or even wholly absent. By following this method the sands are fixed rapidly and with little expense, because the use of an inert covering is to a great extent, and sometimes completely, avoided.

45 – **Tillage and Sod Mulch in the Orchard.** — HEDRICK, U. P., in *New York Agricultural Experiment Station, Bulletin* No. 375, pp. 80 + 7 plates. Geneva N. Y., 1914.

Mr. Hitchings' apple orchard near Syracuse, in the State of New York, has produced during the last fifteen years more prize-winning apples at the annual State fairs in New York than any other orchard in the State. It is unique for the lay of the land and the soil, and the trees have been planted, pruned and sprayed and the soil treated in very original ways. It lies in the bottom and on the foothills of a deep valley and on too steep an incline for convenient cultivation, as under constant tillage the soil would wash more or less. The soil is soft, moist, and, throughout the year, but especially in early spring, it contains much water, notwithstanding well constructed open ditches to carry it away.

Mr. Hitchings' method of sod mulching consists in laying the ground to sod before or as soon as the trees are set, never tilling it and cutting the grass for a mulch once or twice, as conditions may demand, during each summer. The cut grass is never removed but raked and piled about the trees. Neither straw nor similar material is added.

The above method has been the subject of much discussion and, in order to compare it with tillage in apple orchards, the New York Agricultural Experiment Station rented for ten years, from 1903 to 1913, several plots in Mr. Hitchings' orchard, continuing during the whole decade this method side by side with the usual method of tillage.

The experimental work was carried out on three plots. Plot *A* is on level ground in the bottom of the valley: it contains 8 rows of 34 trees each, which at the beginning of the experiment had been set two years, of the Rhode Island Greening, Sutton and Wagener varieties.

Plot *B* is in the lower part of the hillside orchard. It consists of 6 rows of 13 trees each. The varieties represented are Alexander, Wealthy and Fameuse and the trees were nine years old at the beginning of the experiment.

Plot *C* is up the slope above plot *B*. The trees are Northern Spy, ten years of age at the beginning of the experiment and planted in five rows of six each. In each plot half the land is in tillage and half in sod.

All three plots appear to be well supplied with phosphorus, potash and nitrogen. At the close of the experiment the analysis of the soil yielded the results shown in the accompanying table.

The amounts of carbon and nitrogen show that there is considerably less humus in the tilled land than in that kept in sod, notwithstanding the (comparatively sparse) cover crops turned under in the tilled plots. The writer concludes that in tilled orchards the cover crops alone in many cases are not sufficient and that the deficiency must be made up by occasional manuring or by a clover sod for a season.

All three plots were on deep soil, and *B* and *C* received the hill-side seepage. All these factors favour the sod mulch method. All plots were given identical treatment. The tilled plots were ploughed early in the spring and cultivated from seven to eleven times, a cover crop, usually of clover, following. In the sod plots there was a mixed growth of orchard grass and

Fertilising matter, in lbs. per acre.

Plots	P_2O_5	CaO	K_2O	Total carbon	N
First seven inches.					
A. sod	4 440	12 600	46 000	50 200	5 80
A. tilled	4 720	8 800	48 400	48 000	5 40
B. sod	4 620	10 800	55 600	63 400	7 20
B. tilled	4 260	14 800	52 400	46 000	5 80
C. sod	3 900	16 600	36 600	74 000	6 60
C. tilled	2 940	12 800	47 600	22 000	3 00
Second seven inches.					
A. sod	2 520	9 600	49 600	33 600	4 20
A. tilled	2 580	7 600	—	26 800	3 60
B. sod	4 400	11 400	55 200	52 400	6 20
B. tilled	4 580	12 400	—	—	5 60

blue grass. These grasses were mowed once during the summer, usual about the middle of June, and left as they fell.

The yields were not so satisfactory as could be desired: the trees sod bore an average of a little less than four bushels while those in tillag bore a little more than three bushels per tree. The trunk developmer was the same under one method as the other. In plot *A* on the floor the valley those under tillage showed greater diameter of the trunk. Th is explained by the fact that the hill seepage furnishes an abundance moisture for both trees and grass, but in the drier soil of the slope, tre in sod cannot compete successfully with the grass for moisture.

In comparing costs, the extremes are too far apart.

The cost of tilling plot *A* was at the rate of $11.22 per acre, Plot $13.30 per acre and Plot *C* $24.33. For cutting grass in plots *A* and 60 cents per acre were paid, and 96 cents per acre in Plot *C*. The averag for the tilled plots was $16.28, for the sod plots 72 cents per acre. The figures show that the cost of tillage varies greatly, depending upon lan tools, teams, number of cultivations and other factors. The cost of cuttir grass will be more nearly the same for all orchards.

There was little difference in size between the apples in the tw sections, while those of the sodded plots were much more highly colour and more attractive in appearance and moreover ripened a little earlie The colour of the foliage of the tilled trees was darker and richer than the sodded trees.

Previously to this experiment, the New York Agricultural Experiment Station had carried out comparative tests of the Hitchings method and of the usual tillage method at Auchter near Rochester. There the tillage method proved superior, here the reverse was the case. The conclusion to be drawn is that while the tillage method is generally advisable in most of the orchards in the State of New York, the Hitchings method may be more advantageous under special conditions, such as considerable depth of soil, land on steep hill-sides, easily washed away, or very stony. Besides, the choice between the two methods may be determined by economic conditions, for even if the yield in fruit be inferior, the lower cost of cultivation of extensive orchards might counterbalance the lower production.

146 – **Some Analyses of Guanos of Recent Extraction.** — HUTIN, A., in *Annales de Chimie analytique*, Year 19, Vol. 19, No. 9-12, pp. 332-333. Paris, September-December 1914. MANURES AND MANURING

The writer has made a chemical analysis of six different guanos from the Chinchas Islands, and in each case obtained a total percentage exceeding 100; this he attributes to the complexity of the material, whose constituents are probably not present in the combinations generally assumed for analysis.

The following figures show the results.

	I	II	III	IV	V	VI
Cl	6.50	6.08	7.21	7.14	0.15	0.20
H_2SO_4	5.65	5.25	5.18	5.27	3.51	3.42
P_2O_5	7.90	8.11	7.73	6.91	8.79	9.02
CaO (as carbonate)	0.30	0.22	0.17	0.19	2.53	3.20
CaO (as phosphates)	8.99	8.86	9.55	9.17	10.50	10.10
CO_2	0.15	0.18	0.13	0.16	2.10	2.00
N	2.98	3.02	3.19	2.94	**9.27**	**9.30**
MgO	4.20	4.40	4.04	3.32	0.90	0.80
Fe_2O_3	4.90	4.80	4.40	6.32	0.70	0.60
K_2O	4.08	3.50	3.93	2.47	3.02	3.52
Al_2O_3	0.19	0.19	0.18	0.16	0.16	0.25
Loss on ignition (organic matter)	14.20	14.26	16.08	16.30	**56.08**	**55.50**
H_2O	4.25	5.00	4.50	3.50	4.50	4.10
Insoluble residue	40.00	40.60	40.10	40.55	**3.02**	**3.80**
Totals	104.29	104.47	106.39	104.40	105.23	105.81

Samples I-IV are guano washed by sea-water (phosphatic guano), while samples V and VI are guanos rich in nitrogen. It should be remarked that chlorides are always abundant in phosphatic guanos; an average of 40 to 50 determinations of each type of guano shows 9.70 per cent of chlorine in phosphatic guanos and 3.46 per cent in nitrogenous guanos. It follows that phosphatic guanos are very deliquescent owing to the hygroscopicity of the chlorides which they contain; this may give rise to rotting of the sack and also loss of nitrogen.

147 – **The Influence of Fineness upon the Availability of Bone Meal.** — PECK, S. S. (Experiment Station, Hawaiian Sugar Planters' Association) in *The Journal of Industrial and Engineering Chemistry*, Vol. VI, No. 11, pp. 922-926. Easton, Pa., November 1914.

A commercial bone meal was sifted and separated into four grades according to fineness:

No. 1 passing through a sieve with 40 meshes to the inch
No. 2 » » » » 20 » » »
No. 3 » » » » 12 » » »
No. 4 retained by » » » » » »

Portions of each of these grades were mixed with 200 gms. of soil in amounts sufficient to provide 0.1 per cent of nitrogen; the soil was placed in beakers and maintained at one-half or two-thirds saturation for 18 to 20 days, during which time determinations of ammonia and nitrate were made at intervals. A summary of the results is given in Table I.

TABLE I. — *Decomposition of nitrogen in bone meal.*

Grade of bone meal	Milligrams of nitrogen in 200 gms. soil								
	As ammonia	As nitrate	Total	As ammonia	As nitrate	Total	As ammonia	As nitrate	Total
I. — *Two-thirds saturation:*	After 5 days			After 11 days			After 18 days		
Blank	0.14	—	—	0.14	—	—	0.14	2.1	2.24
No. 1	12.88	—	—	4.20	—	—	1.80	29.32	31.12
No. 2	4.48	—	—	2.38	—	—	3.08	13.40	16.48
No. 3	3.92	—	—	0.98	—	—	1.12	10.80	11.92
No. 4	2.24	—	—	0.28	—	—	1.26	13.40	14.66
II. — *Half saturation:*	After 4 days			After 10 days			After 17 days		
Blank	2.31	4.20	6.51	0.84	4.62	5.46	1.26	4.20	5.46
No. 1	9.80	3.92	13.72	7.42	9.24	16.66	2.38	17.92	20.30
No. 2	9.94	3.22	13.16	5.18	10.64	15.82	1.96	14.98	16.94
No. 3	10.08	3.08	13.16	4.76	7.70	12.46	0.98	15.56	16.54
No. 4	8.12	3.08	11.20	2.24	9.94	12.18	1.26	13.30	14.56

As the size of the particles in the bone meal decreased, decomposition of the nitrogenous constituents increased. In order to prevent the accumulation of nitrates in the soil, which might introduce errors in the results, the tests were repeated with lysimeters which consisted of galvanised iron cylinders 2 ft. × 8 in. Each contained 40 lbs. of soil, to which the bone meal was added at the rate of 100 lbs. of nitrogen per acre (363.5 mgms. per lysimeter). At intervals of three weeks the lysimeters were

leached with 3 litres of water and the washings were analysed for nitrates, lime and phosphoric acid, with the results given in Table II.

TABLE II. — *Nitrate nitrogen, lime and phosphoric acid removed from lysimeters in* 15 *weeks, calculated in lbs. per acre of surface.*

Grade of bone meal	Nitrate nitrogen		Lime		Phosphoric acid	
	Removed	Excess over blank	Removed	Excess over blank	Removed	Excess over blank
Blank	23.6	—	79.6	—	4.4	—
No. 1	39.6	16.0	87.4	7.8	6.4	2.1
No. 2	34.3	10.7	55.9	—	5.2	0.9
No. 3	32.3	8.7	91.9	12.3	5.4	1.1
No. 4	31.4	7.8	82.5	2.9	6.0	1.7

These results confirmed those obtained in the previous experiments in so far as the finer the state of subdivision of the bone meal, the greater the decomposition of its nitrogenous constituents. It was thought that the amounts of lime found in the washings might give some indication of the rate at which the lime phosphate was dissolved within the soil, but the results were too irregular to allow any interpretation. With regard to the phosphoric acid, the differences observed were within the limits of the experimental error, but the finest meal showed a greater solubility than the coarser grades.

A final test was made with an attempt to measure the amount of phosphoric acid rendered soluble by bacterial action. Five grams of each of the grades of bone meal were mixed with 200 gms. of pure quartz sand moistened with soil extract; the mixture in each case was placed in a beaker and analysed for phosphates soluble in water after three and five weeks. The following amounts of phosphoric acid soluble in water were found after five weeks:

	Mgms. of soluble phosphoric acid
Meal No. 1.	7.4
» No. 2.	6.0
» No. 3.	6.3
» No. 4.	4.4

These results show that the solubility of phosphoric acid in bone meal is largely dependent on the size of the particles, since the finest grade yielded 70 per cent. more soluble phosphoric acid than the coarsest grade.

Since there is a limit to which bone meal can be ground to permit of its convenient handling, fine bone meal should be defined as that which passes through a sieve with 50 meshes to the inch. In view of the fact that it is not commercially practicable to prepare so fine a product without

also including a considerable proportion of the very fine dust which is objectionable, the writer suggests that a standard be adopted for "fine" bone meal according to which 65 per cent of the meal should pass through a 50-mesh sieve and at least 90 per cent of the remainder should pass through a 25-mesh sieve.

148 – **New Experiments on the Action of Nitrogenous Manures in Germany and Austria.**—I. GERLACH, M. (reporter); KRÜGER, W.; ROEMER, H.; TACKE, BR.; SCHULZE, B.: SCHNEIDEWIND, W.; IMMENDORFF, H. Bericht des Deutschen Landwirtschaftsrats betreffend Feldversuche über die Wirkung verschiedener stickstoffhaltiger Düngemittel. — *Berichte über Landwirtschaft, herausgegeben im Reichsamte des Innern*, Part 34, 229 pp. Berlin, 1914. — II. HASELHOFF, E. Versuche mit Stickstoffdüngern (Mitteilungen der landw. Versuchsstation in Harleshausen, Kreis Cassel). — *Die landwirtschaftlichen Versuchsstationen*, Vol. LXXXIV, Part I and II, pp. 1-55. Berlin, 1914. — III. REITMAIR, O., and ALEXANDER, TH. Die Wirkung von Kalksalpeter und Natronsalpeter, Feldversuche aus dem Jahre 1912 (Mitteilung der k.k. landw. Versuchsstation in Wien), — *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 10–11, pp. 729–807, + map. Vienna, October-November 1914. — IV. HILTNER, L., and LANG, F. Versuche über die Wirkung verschiedener Luftstickstoffdüngemittel, 1. Feldversuche. — *Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year XII, Part 11, pp. 121-128. Stuttgart, November 1914.

I. — Parallel experiments were carried out in seven stations and reports were made on the following six: Bernburg, Bremen, Bromberg, Breslau, Halle and Jena. The experiments were carried out with grants from the German Council for Agriculture on behalf of the Union of Agricultural Stations of the German Empire, and were designed to determine the value of the various nitrogenous manures on a large scale, on the basis of the results already known. They were conducted on sandy, loamy and moor soils, with both cereals and root crops, using the following manures: nitrate of soda, sulphate of ammonia, calcium cyanamide, nitrolim (Stickstoffkalk), nitrate of lime, liquid manure, and in certain cases nitrite of lime. Their duration was fixed at three years, but in some cases it was reduced to two or one, and in the majority of cases the secondary effects could not be verified. The general method followed was that of WAGNER (*Arbeiten der D. L. G.*, 80) as used throughout the experiments of the German Agricultural Stations.

The comparative examination of the results obtained is given in Table I, in which the useful effect of a given manure is expressed in terms of percentage of the effect of a corresponding quantity of nitrate of soda given in a single application.

The difference between the two series for *nitrate of soda* is very small; on the lighter soils it appears to be preferable to apply it in two dressings, whilst on heavy soils this course is advantageous only in the case of barley and potatoes; for oats and sugar-beets the manure should be given all together before sowing. In any case, owing to the small differences and the limited number of the experiments these results are not conclusive.

With regard to *sulphate of ammonia* it should be noted that if the results of the wheat plots were omitted the average value would be increased from 84 to 89. Its effect on peaty soils was remarkable, the results for

TABLE I. — *Comparative value of various nitrogenous manures* (nitrate of soda = 100).

Crop.	Nitr. of soda applied in		Sulphate of ammonia	Cyanamide or nitrolim				Nitrate of lime	Nitrite of lime	Liquid manure
	one dressing	two dressings		in peaty soil	in sandy soil	in loam	Mean			
ye	100	105	93	71	77	—	74	97	—	—
heat	—	—	54	—	—	87	87	105	—	—
arley	100	103	89	—	—	75	75	110	—	81
ats,	100	102	97	67	85	86	79	109	70	75
otatoes	100	103	94	90	75	69	78	102	110	50
ugar-beets	100	90	95	—	64	68	66	97	89	49
angels	100	74	68	—	—	72	72	73	—	—
Average values	100	96	84	—	—	—	76	99	90	64

ve, oats and potatoes being respectively 109, 103 and 102 ; it gave better esults on sandy soils than on loams, especially with root crops.

Though unfavourable results had been obtained with *calcium cyanamide* n fen peat, comparatively good results were obtained in this series on moor oils. Also, though it had often been supposed that cyanamide had a ss favourable action on light soils than on heavy ones, the above experi- ents do not show any considerable difference between sands and loams.

With regard to the assimilation of nitrogen in its different forms, he average results of five stations show that the crops absorbed 61 per nt. of nitrogen as nitrate of soda; reckoning this as 100, the nitrogen ssimilated from the other manures is as follows :

Nitrate of lime	Sulphate of ammonia	Cyanamide	Liquid manure	Nitrate of lime
—	—	—	—	—
91	78	65	57	54

The experiments tend to show that the various nitrogenous manures ave little influence on the percentage of nitrogen in the crops, especially the case of roots and tubers, as well as in leaves and other herbaceous arts ; in the cereals there is an occasional increase in the percentage of itrogen, shown chiefly in the straw and after applications of nitrates of oda and lime ; in any case the effect is of little importance. The quality f the crop also is scarcely affected by the different manures, with respect either the ratio of grain to straw, or the percentages of starch in the otatoes and of sugar in the beets.

II. — This article deals with a series of pot culture expriments carried ut during 1907 to 1909 at the Agricultural Station of Marburg and during

1911 to 1913 at the Harleshausen Station. These experiments are c special interest from the determination of the manurial value of certai nitrogenous products, such as urea and guanidine and its derivatives, obtain able from calcium cyanamide by catalytic action (manganese dioxide Schlösing's nitrate (a nitrate of lime containing about 10 per cent. of fre lime), Burkheiser's salt (obtained by his process of coal gas purificatio and containing $\frac{1}{3}$ sulphite of ammonia and $\frac{2}{3}$ sulphate of ammonia), th residues of casein and galalith obtained from the manufacture of artificia ivory by treatment of casein with formaldehyde. The conclusions draw from these experiments are as follows:

1. *Action of nitrogenous manures on yield of crops.*

a) The nitrogen in *sulphate of ammonia* is on the whole equivalent t that of nitrate of soda, the action being more favourable in loams than i sandy soils; ploughing-in in autumn, is better than spreading it on th surface in the spring.

b) The action of *nitrate of lime* on cereals is sometimes greater an sometimes less than that of nitrate of soda; its action is generally mor favourable in loams than in sandy soils; on the whole the action of the tw nitrates may be considered equivalent. The action of nitrate of lime o carrots was also sometimes more and sometimes less favourable than tha of nitrate of soda, and in every case the addition of common salt increase the yield.

c) *Schlösing's nitrate* was found to be equivalent to nitrate of sod for wheat and spring barley; as a top-dressing for wheat it showed no dis advantage.

d) *Nitrate of potash* obtained from calcium nitrate gave the same re sults with barley as nitrate of soda.

e) *Nitrate of ammonia* has given similar, if not better, results.

f) The results obtained with *nitrite of soda*, on the contrary, hav generally been inferior and the decrease of crop was more pronounced with spring application than with autumn application. In this respec it is necessary to point out the injurious effect of nitrite of soda on germi nation, though the quantity present in nitrate of lime is so small as not t diminish its fertilising value.

g) *Cyanamide* ploughed in deeply in autumn for barley has give better results than nitrate of soda under similar conditions, but when onl buried superficially it was somewhat inferior to nitrate of soda; in the spring and especially when only buried superficially, cyanamide was distinctl inferior to nitrate of soda; when only buried to a slight depth, it had a injurious action on germinating in both autumn and spring, though i both cases applied three weeks before sowing. In the case of oats th differences were less obvious as compared with both nitrate of soda an nitrate of lime, almost disappearing on loamy soils, but increasing on sand soils; however, when the next year's yield is considered the action of cyana mide is generally inferior.

h) *Lime-nitrogen* (Stickstoffkalk) has generally an action similar t that of cyanamide, though it is sometimes inferior.

i) *Urea* is not inferior to nitrate of soda, and in some cases is even superior ; in comparative trials with sulphate of ammonia the yield was inferior, the effects being a little better in loamy soil than in sandy soil.

j) *Nitrate of urea* and *nitrate of guanidine* have a similar action to that of urea.

k) The results obtained with *guanidine* are such that it cannot be considered as a fertiliser.

l) *Burkheiser's salt* appears to be a little inferior to sulphate of ammonia when applied to buckwheat and mustard ; in a trial with barley it gave a better result than nitrate of soda.

m) *Galalith*, especially on loamy soils, has given good results, hardly inferior to those obtained with nitrate of soda ; on sandy soils the yield was diminished, especially when the manure was applied in a coarse condition.

2. *Action of nitrogenous manures on nitrogen content of crop.* — The quantity of nitrogen in the crop was generally increased with the application of nitrogenous manures.

3. *Utilisation of nitrogen from the different manures.* — Comparison between the utilisation of nitrogen from *sulphate of ammonia* and that from *nitrate of soda* shows a relation similar to that of the yields from these manures ; applied as a top-dressing to barley, ammoniacal nitrogen is less effective, especially on loamy soils. The absorption of the nitrogen of *nitrate of lime* was generally considerably less than that of the nitrogen of nitrate of soda, though it was better on sandy soils than on loamy soils. *Schlösing's nitrate* closely resembles nitrate of soda, while *nitrate of potash* and *nitrate of ammonia* are somewhat inferior, and are followed at a considerable distance by *nitrite of soda*, especially when this is applied in the spring. The utilisation of the nitrogen of *cyanamide* is better than that of the nitrogen of nitrate of soda when the former is ploughed in deeply in autumn ; it is less effective when applied in spring, either ploughed in deeply or only lightly covered ; at all times the nitrogen of cyanamide is more effective in loamy soils than in sandy soils. The nitrogen of *lime-nitrogen* is of similar efficiency, being considerably inferior when buried only superficially. The nitrogen of *urea* is more effective when the manure is worked into the soil than when it is applied as a top-dressing ; it sometimes shows remarkable differences in comparison with nitrate of soda, but less obvious differences compared with sulphate of ammonia. The nitrogen of *nitrate of urea* and of *nitrate of guanidine* is very similar to that of urea, but that of *guanidine* is less effective. The nitrogen of *Burkheiser's salt* is less effective than that of sulphate of ammonia when applied to buckwheat and mustard or than that of nitrate of soda when applied to barley. The nitrogen of *galalith* is not utilised as well as that of nitrate of soda, but it is very useful for succeeding crops.

III. — This series of experiments was carried out on a large scale under farming conditions, in a similar manner to the other series of researches, made by Section I of the Vienna Agricultural Experiment Station. The number of comparative experiments between nitrate of lime and nitrate

of soda organised was 188, of which 91 gave reliable results, and 69 uncertain results, the remainder being faulty. The results obtained are summarised in Table II. The price of the unit of nitrogen is based on the quotations for 1912 and is the same for the two manures.

TABLE II. — *Comparative effects of nitrate of soda and nitrate of lime under practical field conditions.*

No. of Experiments	Crop	Increase of crop, lbs per acre				Value of increase per acre				Cost of manure per acre	Total net profit per acre	
		Grain, roots or tubers		Straw		Grain, roots or tubers		Straw				
		Nitrate of soda	Nitrate of lime	Nitrate of soda	Nitrate of lime	Nitrate of soda	Nitrate of lime	Nitrate of soda	Nitrate of lime		Nitrate of soda	Nitrate of lime
						s d	*s d*	*s d*	*s d*	*s d*	*s d*	*s d*
19	Rye	430	380	580	600	27 4	24 4	6 4	6 8	10 0	23 8	21 0
23	Oats	285	260	365	490	18 0	16 4	4 0	5 8	10 0	12 0	12 0
28	Potatoes	3 100	2 590	—	—	69 8	58 0	—	—	20 0	49 8	38 0
15	Beets	5 750	4 925	—	—	64 4	55 4	—	—	20 0	44 4	35 4
4	Maize	900	680	—	—	40 4	30 4	—	—	20 0	20 4	10 4

Calculating the results to perçentage of the figures for nitrate of soda, we get the figures shown in Table III.

TABLE III.

Crop	Excess of yield (not including straw)		Net profit	
	Nitrate of soda	Nitrate of lime	Nitrate of soda	Nitrate of lime
Rye	100	89.6	100	88.7
Oats	100	90.6	100	100.0
Potatoes	100	83.4	100	76.6
Beets	100	85.7	100	79.7
Maize	100	75.2	100	50.8

It is therefore concluded that nitrate of soda has generally a more favourable action than nitrate of lime, especially with root crops.

IV. — Owing to the cessation of the importation of nitrate of soda to Germany, synthetic nitrogenous manures, of which a great increase in production is proposed, assume greater importance. A series of experiments carried out on light land on the Moosacher Experiment Fields of the Royal Bavarian Institute of Agricultural Botany has given the results shown in Table IV. These results show the favourable effect of calcium

cyanamide as a top-dressing, whilst a parallel series of experiments with potatoes gave negative results, so that for the latter crop this manure is not to be recommended.

TABLE IV. — *Nitrogenous manures for barley.*

Manure.	Total yield per acre lbs.	Manure.	Yeild of grain per acre lbs.
Nitrate of lime, top-dressing	7 380	Nitrate of soda, top dressing	2 565
Nitrate of soda »	7 315	Nitrate of lime »	2 486
Urea »	6 900	Nitrate of urea »	2 403
Nitrate of urea »	6 890	Sulphate of ammonia, top-dressing	2 362
Nitrate of ammonia »	6 800	Nitrate of ammonia »	2 352
Nitrate of lime, ploughed in	6 720	Cyanamide »	2 346
Cyanamide, top-dressing	6 420	Urea »	2 313
Nitrate of soda, harrowed in	6 330	Nitrate of lime, ploughed in	2 305
Nitrate of soda, ploughed in	6 310	Nitrate of soda »	2 168
Sulphate of ammonia ploughed in	6 310	Nitrate of urea »	2 146
Sulphate of ammonia, top-dressing	6 250	Nitrate of soda, harrowed in	2 142
Nitrate of ammonia, ploughed in	6 160	Nitrate of ammonia, ploughed in	2 127
Nitrate of urea, harrowed in	6 110	Urea »	2 108
Urea, ploughed in	6 040	Sulphate of ammonia »	2 092
Nitrate of urea, ploughed in	5 930	Nitrate of lime, harrowed in	2 063
Nitrate of ammonia, harrowed in	5 910	Sulphate of ammonia, harrowed in	2 043
Sulphate of ammonia, harrowed in	5 890	Urea »	1 998
Urea »	5 800	Nitrate of urea »	1 990
Nitrate of lime »	5 600	Nitrate of ammonia »	1 986
Cyanamide, ploughed in	5 500	Cyanamide, ploughed in	1 879
Cyanamide, harrowed in	4 910	Cyanamide harrowed in.	1 794

149 – **Increase in the Production of Synthetic Manures in Germany.** — I. *Der Saaten-, Dünger- und Futtermarkt*, Year 20, No. 49, p. 1529. Berlin, December 15, 1914. – II. *Zentralblatt für die Kunstdünger-Industrie*, Year XIX, No. 24, p. 438. Mannheim, December 15, 1914.

On the initiative of the Prussian Ministry of Agriculture an exchange of views has taken place between the "Kalkstickstoffwerke" (Cyanamide factories) (1) of Knapsack near Cologne, the "Bayerische Stickstoffwerke" (Bavarian factories for the utilisation of atmospheric nitrogen) of Trostberg, and the "Badische Anilin- und Sodafabriken" (Baden aniline and soda factories), also with a group of industrial electrotechnical engineers, with a view to effecting a rapid increase in the manufacture of calcium cyanamide and synthetic ammonia. The State has promised its support and the projects should come into action so as to effect an increase of production available for the autumn of 1915 (2).

150 – **Development of the Culms of Grasses.** — HOLE, R. S. (Botanist, Imperial Forest Service, Forest Research Institute, Dehra Dun, India). — *Forest Bulletin* No. 25, pp. 13. Calcutta, 1914.

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In wheat, although the length of the lamina of the lower leaves does increase progressively upwards, there is no sudden, marked, difference in

(1) The property of « A. G. für Stickstoffdünger ». (*Ed.*).
(2) See above, No. 148. (*Ed.*).

length between the leaves of adjacent nodes. On the other hand the 5th-7th internode from the base is some 20-60 times as long as the internode next below it. This difference sharply separates the basal portion of the culm composed of very short internodes from the upper part consisting of long internodes progressively increasing in length upwards.

In wheat there are therefore two well-defined periods of development: during the first, the winter period of slow growth, 4-6 very short internodes are produced together with the buds which form the tillers; during the second period, in spring, the long internodes and the ear are formed. The writer calls the first the period of preparatory growth and the second the period of vigorous growth.

In the average primary culm the same number of leaf-bearing internodes is produced in these two stages of growth, but the period of preparatory growth is approximately three-quarters of the period of vigorous growth.

The average number of long leaf-bearing internodes produced in the primary culm is approximately equal to the number of months in the period of vigorous growth.

The average number of long leaf-bearing internodes is practically the same whether calculated from the primary culms alone, from the axillary culms alone or from a mixture of these as found in the final crop.

In the older axillary culms, both growth-periods (but more especially the preparatory period) are shorter than those of the primary culms, and there is little difference between the two classes of culms as regards the date of ripening grain.

In the older axillary culms, the number of leaf-bearing short internodes is approximately half the number of the long leaf-bearing internodes and the preparatory period of growth is approximately half the vigorous growth-period.

The longer the growth period in one and the same species, the greater the number of the internodes, thus showing that plants within certain limits are able to adapt themselves to different growth periods. It is possible that a general correlation exists between the number of internodes in the culm and the length of the period of growth, and that both in annual and perennial grasses, *the average number of leaf-bearing long internodes produced in a culm* (*i. e. excluding the apical segment terminating in the inflorescence*) *is approximately equal to the number of months comprising the period of vigorous growth.*

151 – **Study on Some Crosses of Garden Peas.** — KAPPERT, HANS, in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. XIII, Part $^1/_2$ pp. 1-57 + 20 figs. Berlin, September 1914.

The writer agrees with TEDIN in distinguishing among the best-known forms of cultivated peas the two species *Pisum arvense* and *P. sativum*. In the first he includes all peas with coloured flowers and dark, mostly mottled, seed-coats; in the second all those with white flowers and not decidedly coloured seed-coats. The species *P. sativum* is further divided into two sub-species: *P. sativum saccharatum* (sugar peas), in which the pod on ripening wrinkles up round the seeds and does not open; and

P. sativum pachylobum, with hard pods that open on reaching maturity. This group is further divided into *P. sativum pachylobum sphaerospermum* (round-seeded pea), the seeds of which do not wrinkle on drying, and *P. sativum pachylobum medullare*, or *quadratum* (marrow-fat peas), which on drying form slight depressions (indent peas) or well-defined folds (wrinkled peas). Microscopical examinaton of crosses between these different varieties gave the following results :

1. The statement that within the species *P. sativum* the wrinkled peas contain compound starch grains and the round peas simple grains is not in accordance with facts. It is true that the two strains have starch grains which differ in shape, and in the number and direction of their fissures and in their behaviour towards amyloclastic enzymes, for the round-seeded peas contain elongated starch grains, either whole or with simple fissures, which under the action of diastase and of ptyalin dissolve without forming new fissures ; while the wrinkled peas have roundish starch grains with numerous radial fissures and break up under the action of diastase. The formation of large fissures and the breaking-up of the starch grains in wrinkled peas is evidently due to a process of solution occurring spontaneously in the ripening seed, in which the plasma, which may penetrate into the starch grains, takes part.

2. The hybrids between wrinkled and round-peas contain in F_1, as DARBISHIRE observed, starch grains which are intermediate both as regards their shape and the degree to which they tend to form fissures. The statement of DARBISHIRE that in the F_1 cross two kinds of grains are present, of which one forms fissures in intermediate numbers and the other does not form any, cannot be confirmed by the writer. In his plants, the starch grains of the hybrid F_1 seed in general resembled more those of the round parent ; nevertheless some seeds showed a distinct influence of the wrinkled parent, not so much in their shape as in the trend of the fissures.

In the crosses obtained by the writer in the second generation, the homozygotic smooth seeds could not in all cases be distinguished with certainty from the heterozygotic smooth ones by the simple microscopic examination of their starch. Measurement of the seeds of individual pods showed that there are seeds transitional between the seeds with evidently intermediate starch grains and those with grains of the round type. It is, however, still undecided whether these intermediate forms are due to external influences which modify the form of the starch grains or to heredity according to NILLSON-EHLE'S principle.

3. The wrinkling of marrow-fat peas on drying is caused by a considerable decrease of the volume of the cotyledons, which the spermodern cannot sufficiently follow by shrinking in a tangential direction. Wrinkled peas shelled before ripening remain round on subsequent drying.

The greater decrease of volume of the cotyledons of wrinkled peas is caused by a greater loss of water. The loss of water that the fresh ripe seeds undergo on drying is a feature characteristic for particular strains of peas. For the crosses between wrinkled and round peas, which in this

respect differ sharply, the elimination of water has an intermediate value, but it is mostly remarkably near that of the round parent.

In the second generation of seeds the loss of water varied in the individual seeds of a pod. There is no parallelism between these fluctuations and the form of the starch grains in the seed.

To the greater loss of water on drying shown by the wrinkled peas a greater water content in the fresh peas is found to correspond. The chemical composition of the wrinkled peas (much soluble matter, and little starch), may also render the irregular wrinkling of the surface of the seed more intense. On the other hand the presence of a greater intercellular system, which causes the difference in the specific weight existing between the round peas Carter's First Crop and Laxton's Alpha, might somewhat hinder a still greater decrease in the volume of wrinkled peas. There is, however, no relation between a greater content in sugar, etc., and wrinkling due to the fact that such substances on drying retain water less intensely; the difference in the sugar content of the smooth and wrinkled seeds is too small to have such an effect. Corresponding to the greater water content of wrinkled peas there is also more water in their leaves than in those of round peas. It appears that in wrinkled peas there is a relation between the quantity of soluble carbohydrates and the appearance of the starch grains, and in reality such substances are evidently derived from the successive partial dissolution of the reserve starch, which, according to CORRENS, occurs also in sweet maize.

152 – **Morphological Variability in *Mycoderma vini*.** — PEROTTI, R., in *Atti della Reale Accademia dei Lincei*, Vol. XXIII, Part 9, pp. 423-426. Rome, November 18, 1914.

Experiments have shown that considerable morphological variations are caused in the cells of *Mycoderma vini* by the varying concentrations of glucose, the different origins of the carbon, the differing proportions of the source of nitrogen, the degree of acidity and the proportion of alcohol in the nutritive solution. These variations concern the dimensions, which may be either reduced or increased to twice the normal, and the shape, which may become elongate (bacilliform), rounded (cocciform) or elongated at one pole and rounded at the other.

153 – **The Occurrence and Significance of Manganese in the Seed Coat of Various Seeds.** — MC HARGUE, J. S., in *The Journal of the American Chemical Society*, Vol. XXXVI, No. 12, pp. 2532-2538. Easton, Pa., December 1914.

The writer observed that manganese can readily be detected by qualitative tests in the different parts of seeds, and that certain coats surrounding the kernel contain very notable amounts of this element. He gives in a Table the results of a number of analyses showing the percentages of manganese found by him in the dry material of different parts of seeds, which vary from mere traces to 0.0194, and differ considerably in the different parts of seeds of the same plants. The seed coat immediately surrounding the kernel or cotyledons of seeds contains a larger quantity of manganese than either the kernel or the outer epidermal coats. This concentration is especially noteworthy in the apple, peach, black walnut, acorn, Brazil

nut, chestnut, almond and wheat bran. Wherever it was possible to dissect this thin membrane, usually brown in colour, from the cotyledons to which it is attached, in sufficient amount for analysis, it invariably showed a higher concentration of manganese than any of the other parts of the seed tested.

The constancy of the occurrence of manganese in this tissue appears to be indicative of important biological relations. Experiments were therefore planned with the object of ascertaining if some parallelism could be established between the manganese content and the presence of oxidases in the different parts of the plants under investigation. In these experiments parts of raw plants were tested for the presence of oxidases by grinding a 1-gm. portion with 10 cc. of distilled water, filtering through a dry filter into a test tube, without washing, and adding 2 cc. of a guaiacum solution. The colour that developed was noted as "strong", "moderate", "trace" and "none". The remaining portions of the same plant were then dried, ashed and the manganese determined. The results obtained show that in every case in which manganese was found in appreciable amounts, a corresponding positive result was obtained for the presence of oxidases, and the absence of manganese was accompanied by negative reactions for oxidases. In these experiments it is shown that neither manganese nor oxidases are evenly distributed in the tubers and roots of potatoes, turnips or carrots, each being largely confined to the outer epidermal layers, thus indicating a close relationshilp between manganese, oxidases and free oxygen in the soil.

From the above data in connection with the researches of BERTRAND and others, it is evident that a close relation exists between manganese and oxidases in plants. The writer suggests that the accumulation of manganese in the seed coat sustains a very important relation to the oxidising enzymes in this part of the seeds. It is very probable that these enzymes have much to do with the selection, compounding and storing away of the reserve material in the kernels of seeds, and that manganese also assists in stimulating the enzymes which split up the fats, sugars, starches, etc., and render them more readily available for the young seedling during the early stages of its growth.

154 – **Sap Studies with Horticultural Plants** (1). — CHANDLER, W. H., in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin* No. 14, pp. 491-552 + 13 plates. Columbia, Missouri, May 1914.

From the results of his experiments, the writer draws the following conclusions :

A very small proportion of the osmotic strength of leaf and cortex sap, as measured by the lowering of the freezing-point, is produced by electrolytes, except in the leaves of succulent plants. Generally more than half of the osmotic strength of leaf and cortex sap is produced by neither sugars nor electrolytes.

(1) See also No. 156 below. (*Ed.*).

The molecular weight of the sap solute varies for different tissues, but for any given tissue it does not vary greatly, except in early summer during the period of rapid growth when it seems to be somewhat smaller than at other times.

The method of determining the molecular weight was to determine the freezing-point of filtered sap, weigh out generally four samples and evaporate to dryness and figure the molecular weight from these data, by use of the formula $M = K \frac{w}{d\,w}$, where w is the number of grams of a substance dissolved in w grams of a solvent ; d is the number of degrees that the freezing point of the solution is lower than the freezing point of the solvent and k is a constant for the solvent. In case of water K is 1860.

The molecular weight of the solute of the sap of peach twigs which had been cut back severely so as to make vigorous growth seemed to be smaller during the greater part of the summer than that from the twigs of normal growth.

During the growing period there is a fairly constant increase in the molecular concentration of the cortex sap from the roots up through the trunk and large branches to the twigs, exceptions to this apparently being most common in the trunk. In late winter this greater molecular concentration of the cortex sap in the upper portions of the tree does not generally prevail.

The molecular concentration of cortex sap is smallest during the period of rapid growth. In case of roots especially, and to a lesser extent in other tissues, the molecular concentration of the cortex sap is not as great during early summer with trees that have been forced into vigorous growth by heavy pruning as with trees not so pruned.

A molecular concentration as determined by the freezing-point seems a fair measure of the condition of nutrition, at least of the roots.

The molecular concentration of the young leaves near the growing point of peach and apple twigs is not as great as that of the old leaves.

The molecular concentration of the leaves of fruit trees is generally considerably greater than that of the fruit, except in the case of some ripe fruits like cherries or currants. Where this difference prevails, the leaves are able to remove water from the fruit. There seem to be times in the orchard when the air is very dry and the moisture supply limited, when a large foliage may remove the water from the fruit to an injurious extent.

The bibliography appended to the paper mentions 48 works.

155 – **Is the Antagonistic Action of Salts due to Oppositely Charged Ions?** — LOEB, JACQUES, in *The Journal of Biological Chemistry*, Vol. XIX, No. 3, pp. 431-443. Baltimore, Md., November 1914.

The main object of this paper is an investigation of the question whether antagonistic salt action is based on an antagonism between oppositely charged ions. It is shown that this assumption leads to difficulties if applied to the antagonisation of a toxic salt with a monovalent cation by a salt with a bivalent action.

It is shown that for the toxic concentrations of $MgCl_2$, $CaCl_2$, $SrCl_2$ and $BaCl_2$ the cation is the toxic agency; and that nevertheless, the efficiency of their antagonists is determined by the cation and not by the anion.

156 – **The Killing of Plant Tissue by Low Temperature.** — CHANDLER, W. H. in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin* No. 8, pp. 143-305 + 3 figs. Columbia, Missouri, December 1913.

In these experiments the plants were subjected to low temperatures in a chamber surrounded by ice and salt. The density of the sap was measured in terms of the depression of the freezing-point as determined by a Beckmann Freezing-Point Apparatus.

Of the several forms of injury from cold, such as mechanical injury due to tension developed at low temperature, or evaporation from the surface when the conducting tissue is frozon so as to prevent the movement of water to that tissue, and the killing as a result of long continued exposure to low temperature, it is the last form of injury or *freezing to death* which is dealt with in this paper. It is characterised by the tissue taking on a brown, water-soaked appearance after thawing.

During the freezing of the tissues, ice generally forms in the intercellular spaces, causing a withdrawal of water from the protoplasm. The amount of water loss necessary to result in death varies with the different plants and different tissues.

In the case of plants not in a resting stage the resistance of the tissues to cold is in direct relation to the density of the sap, and conditions which tend to increase the sap density increase the hardiness of the tissues, and vice versa. Increasing the density of the sap by withholding water from plants was found to be more effective than applying salt solutions. This latter method was only found to be effective in sand cultures. Since salts are as effective as organic compounds in solution, it follows that the injury to the protoplasm is due rather to the mechanical withdrawal of water than to the precipitation of the proteins by freezing. It is well known that the cortex, winter buds and sapwood of deciduous trees increase in hardiness during the four to six weeks before leaf-fall. This was found to be associated with a change in the composition of the proteins tending to keep them in solution at lower temperatures, thus furnishing additional proof that " freezing to death " is not due to the precipitation of proteins.

The rate of thawing appears to have no effect on the resistance of the fruit buds and young fruit of peaches, though rapid thawing causes serious injury to ripe apples and pears. It has also no effect on the resistance of leaves and stems of growing plants, except lettuce. Most fruit buds are damaged by rapid freezing, a rapid fall of temperature before zero is reached being much more injurious than below zero. This probably accounts for the phenomenon of "sun scald" in apple trees, and emphasises the necessity of maintaining the temperature of orchards when once the temperature has risen.

The most important feature affecting the hardiness of plant tissue is maturity, that is, the condition of resistance reached during the winter

dormant period. Thus, late growing trees are less resistant to early frosts and rapidly growing cover crops are useful in orchards in checking the growth and promoting the maturity of the bark and buds, thereby increasing their resistance to cold. The bark of various parts of the tree varies considerably in its resistance. In summer the lower portion of the trunk is more resistant than the upper, whereas in winter the converse is true. Trees may be protected from damage during severe winters by heaping manure and straw round the base of the trunk. This increased resistance of the branches over that of the trunks is due not to an increased moisture content of the latter, but to the greater sap density and to changes in the protoplasm which enable it to withstand the great loss of water. The most tender tissues above ground after complete maturity are the pith cells and the fruit buds. Generally young leaves and shoots are more sensitive to cold than full grown leaves, except in the case of lettuce. Succulent plants like cabbage, kale and lettuce are capable of acquiring hardiness by experience, but this is not the case with tomatoes, peas and tender plants generally.

The cambium is least resistant during active growth, but during the winter it is more resistant than the cortex and often survives it. The most tender tissue of the tree at all seasons is in the roots and the degree of tenderness increases with the depth. Different trees show considerable variation in the resistance of their roots.

The maintenance of the resting period is of considerable importance in the resistance of the tree to late frosts. Trees with a vigorous growth late in the year maintain their resting period longer than less vigorous trees. This vigorous growth can be obtained by a judicious application of nitrogenous manures and pruning. Whitewashing the buds, by reflecting the heat, causes them to remain dormant for a longer period.

The pollen of the apple will resist lower temperatures than any other tissue of the flower when in full bloom. Normal pollen has germinated after being subjected to a temperature of -8° C. and, after drying, -12° C. Unopened flower buds are more hardy than those fully opened. Thus flowers, on the outer half of the twigs which open first are less likely to survive a spring frost. The trees should therefore be pruned to a sufficiently open head so that the leaves at the base of the twigs will not be shaded off before fruit buds are formed.

Owing to the great differences in hardiness between the individuals of the same variety, the writer believes that the most effective way of overcoming the dangers of injury from frost is by plant breeding and selection of the more resistant strains.

157 – **Delayed Germination in Seeds.** — CROCKER, W., and DAVIS, W. E., in *Botanical Gazette*, Vol. LVIII, No. 4, pp. 285-310. Chicago, Ill., October 1914.

According to FISCHER and other German authorities, the stimulation of germination in seeds of *Alisma plantago* and other water plants by immersion in dilute acid or alkali is due to a direct stimulation of the dormant embryo.

Extensive investigations on the germination of *Alisma plantago* alone show that the dormancy of the seeds is due to mechanical restraint. Histologically the seed coat consists of three layers: an outer single layer of reddish-brown cells, an inner single layer of white cells and an inner lining of cellular pectic hemicellulose material. Removal of the outer layer of cells has no effect on the germination of the seeds, whilst removal of the inner layers from moist seeds results in an immediate expansion of the embryo due to osmotic swelling, which gradually passes into growth enlargement. Thus, the saturated seed which may remain dormant for years is restrained in its swelling by the inner layers of the seed coat, against which it must be exerting a pressure of approximately 100 atmospheres. The seed coat, being composed almost entirely of pectic substances easily transformed by weak acids and bases or the enzymes of bacteria, may thereby be considerably weakened and unable to resist the osmotic swelling of the embryo. This investigation therefore furnishes additional support of the theory advanced by CROCKER, EWART, KIDD (1), etc. that the dormancy of seeds is dependent on the functions of the seed coat rather than the activity of the embryo.

158 – **On the Formation of Saccharose in the Roots of Sugar-Beets.** — BOUILHAC, Observer, in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 20, pp. 687-689. Paris, November 16, 1914.

It is known that the leaves of beets contain, besides reducing bodies, a variable amount of saccharose, and that the sugar in the root is derived from that in the leaves. Two hypotheses may be formulated to account for the presence of crystallisable sugar in the root: 1) the saccharose from the leaves alone passes by night into the root, which simply stores it; 2) reducing sugar also passes into the root, where it polymerises to form saccharose.

The first of these hypotheses was maintained by GIRARD and after him by the majority of authorities. It is based on the absence of reducing sugar in the root and the disappearance of part of the saccharose from the leaves during the night. But the writer has always been able to determine the presence of reducing bodies in the root: early on their amount in comparison with saccharose is considerable; later it decreases, but these bodies are never absent. Near the neck, where they are most abundant, the proportion may reach 1 in 5. The loss of saccharose from the leaves during the night is not necessarily associated with emigration to the root, for saccharose also diminishes in the dark in detached leaves with their stalks in distilled water, though no trace of sugar appears in the water. It thus appears that saccharose can be transformed in the leaf, independently of any relation between the leaf system and the root.

To determine the nature of the sugar passed from the leaf to the root, the lower part of the petiole should be examined: here a considerable quantity of invert sugar occurs, the proprtion between reducing sugar and

(1) See *B.* Dec. 1914, No. 1106. (*Ed.*).

crystallisable sugar being always well above unity. The composition of the sugars at the base of the petiole lends no support to the idea that saccharose alone passes into the root. It appears, then, that the root receives saccharose for storage and reducing sugar for polymerisation, the amounts of the two sugars entering being regulated by their respective osmotic pressures in the mixture.

The importance of these two functions of the root may well vary in different varieties of beets, so that two varieties which elaborate very different amounts of crystallisable sugar may have roots equally rich in saccharose.

PLANT BREEDING

159 – **Immunity to Fungous Diseases as a Physiological Test in Genetics and Systematics, exemplified in Cereals.** — VAVILOV, N. J., in *Journal of Genetics*, Vol. 4, No. 1, pp. 49-65. Cambridge, June 1914.

The specialisation of fungi to their hosts has suggested the possibility of applying the fungal reactions of plants to the determination of their racial affinities. Numerous cases of this already occur in mycological literature, *e. g.* KLEBAHN corrected the naming of a willow plant in his garden by means of the narrowly specialised rust *Melampsora ribesii-purpureae*; ERIKSSON showed that the hybrid between wheat and rye resembles wheat more closely than rye, since it is immune to *Puccinia dispersa* (brown rye-rust) and susceptible to *P. triticina*. These reactions can only furnish useful results when the parasites show narrow specialisation for their hosts. This is the case with many fungi found on cereals and by this means it has been possible to divide many varieties of wheat and oats into their component races.

For example, in the species *Triticum dicoccum*, which is represented by many varieties and races, it was ascertained that there exist two groups of races : one immune to brown rust and the other susceptible to it. It is interesting to note that these resistant forms are very similar morphologically in the structure of ears and leaves to several varieties of *T. durum*, which possess the same degree of immunity to brown rust. In the investigation of 580 races belonging to the species *T. vulgare*, which is generally susceptible to mildew (*Erysiphe graminis* D. C.), a certain spring race was found to be perfectly immune to mildew. It was also relatively immune to brown rust (*P. triticina*). This wheat was obtained from Germany under the name of " Persian Wheat ". Although a number of morphological characters show that it belongs to *T. vulgare* var. *fuliginosum* Al. — a variety with black bearded hairy ears and red grains — yet it is distinguished by many other characters from all our races of *T. vulgare* which are not included in the classification of KOERNICKE. The straw is full of pith and the nodes are visibly hairy ; the rachis is only half the width of that of ordinary wheats and both empty and flowering glumes are awned. Cross pollination between this " Persian wheat " and other varieties of *T. vulgare* gave very poor results, and in the F_1 hybrids about 70 % of the spikelets were sterile. Further, the F_1 hybrids from this wheat and *T. vulgare* var. *lutescens* (a variety very susceptible to mildew) showed considerable resistance to mildew and could only be infected with great

difficulty, whilst in the case of other F_1 hybrids of *T. vulgare* susceptibility to disease is completely dominant. This " Persian wheat " must therefore be considered to be genetically distinct from *T. vulgare*.

Another instance occurred in an investigation of two-rowed barleys collected from different parts of Russia. According to KOERNICKE all naked two-rowed barleys are represented by one variety — *Hordeum distichum* var. *nudum* L. It was noticed that one of these races under observation was distinctly less susceptible to *Puccinia simplex* Eriks. than the other races. Further observations showed it to be distinguished from the others by weak development of the lateral spikelets, as in var. *deficiens* Steud., and it was described in a later edition of Koernicke (1908) under the name of *Hordeum distichum* var. *nudideficiens*. This particular variety was received from the Caucasus (Daghestan).

Connection between the fungal reactions of cereals and their genetics. — Although the work of BIFFEN and NILSSON-EHLE has shown that immunity and susceptibility may be combined by the aid of crossing with any group of morphological characters, the occurrence and distribution of these two characters is not accidental or without definite order. Investigation of 800 races of spring and winter wheat from different parts of Europe and Asia with regard to *Puccinia triticina* Eriks. and *Erysiphe graminis* D. C. showed that each of the eight species of wheat (*T. vulgare*, *T. compactum*, *T. durum*, *T. polonicum*, *T. turgidum*, *T. spelta*, *T. dicoccum* and *T. monococcum*), including numerous varieties and races, has a definite characteristic behaviour in relation to fungi, as shown in the following table:

I. In relation to *Puccinia triticina* Eriks.

Susceptible.	Resistant.
T. vulgare Vill. (a few immune races).	*T. durum* Desf.
T. compactum Host.	*T. polonicum* L.
T. spelta L.	*T. turgidum* L.

PERFECTLY IMMUNE.

T. monococcum L.

T. dicoccum has both susceptible and immune races.

II. In relation to *Erysiphe graminis* D. C.

Susceptible.	Resistant.
T. vulgare Vill. (except a few races).	*T. durum* Desf.
T. compactum Host. (*T. compactum* var. *creticum* is relatively immune).	*T. polonicum* L.
T. spelta (a little less than the preceding).	*T. turgidum* L.
	T. monococcum L.

T. dicoccum Schr. has both susceptible and immune races.

This generalisation is also applicable in some degree in relation to other fungi, such as yellow rust (*P. glumarum*). Notwithstanding the great polymorphism of these species of wheats, we find that whole species exhibit specific pecularities in their fungal reactions, and many of the excep-

tions in *T. vulgare* represent products of artificial crossing in recent times. Examination of the characteristics of the eight species of wheat in relation to fungi, shows their remarkable agreement with several genetic conceptions already established concerning their relationship.

T. monococcum L. is regarded as a species independent from the rest chiefly on account of the sterility of its hybrids. Its wild progenitor has also been known a much longer time. This genetic individualisation is confirmed by its fungal reactions. All its known wild and cultivated varieties are perfectly immune to brown and yellow rusts and also to stinking smut (*Tilletia tritici*).

T. compactum Host.: some authors consider these dwarf wheats as allied to *T. vulgare* Vill. Their fungal reactions to mildew and brown rust are the same.

T. polonicum L. and *T. turgidum* L. are considered by systematists as species allied to *T. durum* Desf. All three resemble each other in the structure of their ears and also in their vegetative organs. All three are immune to *Puccinia triticina, P. glumarum* and *Erysiphe graminis*.

T. dicoccum Schr., or Emmer, is considered as the polymorphic progenitor species from which the susceptible and immune species as *T. vulgare. T. durum*, etc. (except *T. monococcum*) are descended. In accordance with this view, we find in this species, races both immune and susceptible to mildew and brown rust.

The same parallelism of fungal reactions and the genetic relations is observable in oats. According to present views oats have a polyphyletic origin: *A. fatua* L., *A. sterilis* L. and *A. ludoviciana* Dur. are considered to be the ancestors of our cultivated forms *A. sativa* L. Representatives of all these species proved to be equally susceptible to the narrowly specialised crown rust (*P. coronifera*) like the majority of cultivated oats. *A. strigosa* Schreb. and *A. brevis* Roth, two species rarely cultivated are morphologically similar and give fertile hybrids. Both are relatively immune from crown rust and thereby distinguished from wild and cultivated oats. *A. strigosa* is also immune to *Ustilago avenae*. Many attempts to obtain hybrids between *A. strigosa* and *A. sativa* (cultivated) have proved unsuccessful, thus confirming the peculiar genetic position of this species.

One objection against the general application of fungal reaction for genetic purposes is the phenomenon of so-called "bridging species." Considering the very few cases of this phenomenon, it is very probable that, as FREEMAN and JOHNSON suggest, the different biologic forms of a given species are merely different races. Thus, it is possible that the phenomenon of "bridging species" may be the result of unconscious selection of different races of fungi by the aid of different hosts. It is therefore important that the exactitude of fungal reactions be studied as in the case of chemical reagents before using them for genetic purposes. Fortunately this preliminary work is more advanced in the case of the fungi attacking cereals than it is with any other group of fungi. Compared with the

so-called "serum" methods of testing plants, the fungal reaction shows the same degree of sensitiveness and is much simpler in its application for the recognition of individuals.

160 – **The Mode of Inheritance of Semi-Sterility in the Offspring of Certain Hybrids (*Stizolobium*).** BELLING, JOHN (Florida Agr. Exp. Station) in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. XII, No. 5, pp. 303-342 + figs. 1-17 (Article in English). Berlin, July 1914.

Sterility of F_1 hybrids is very common in many species of plants and its heredity has been investigated in breeding experiments with forage crops. The various species of *Stizolobium* are very valuable forage crops in sub-tropical regions. The Florida Velvet bean (*Stizolobium deeringianum* Bort). possesses the most valuable characters and it has been used as a parent in crosses with the Lyon bean (*Stizolobium niveum* [Roxburgh] Kuntze), the Yokohama bean (*Stizolobium hassjoo* Piper and Tracy) and the China bean (*St. niveum* var ?). In each of these crosses partial sterility appeared in the F_1 hybrids.

Large numbers of specimens of the parent forms were examined microscopically for sterility of the pollen grains and ovules and it was found that the healthy flowers of all four species contained pollen with nearly 100 per cent of good grains, and ovules with nearly 100 per cent of completely formed embryo-sacs. Thus no sterility existed among the parent types.

Examination of the pollen grains and ovules of the F_1 hybrids showed that 50 per cent of the pollen grains lose their living contents while in the vacuolated stage, the remaining 50 per cent becoming full of cytoplasm and developing into normal grains; and that 50 per cent of the embryo-sacs of the F_1 hybrids abort long before maturity, the other 50 per cent being quite normal. Thus the microspores and macrospores of the F_1 hybrids segregate into viable and non-viable in the ratio of 1 : 1.

The flowers of the second generation (F_2) were examined and it was found that 50 per cent of the plants have sound pollen grains and good ovules and the other 50 per cent have half their pollen grains and half their embryo-sacs aborted. Similar results were obtained on examining the third generation hybrids.

Thus plants with normally fertile parents produce normal progeny irrespective of the generation, and plants with semi-sterile parents produce progeny half of which are normal and half semi-sterile in both pollen grains and ovules.

The following explanation is offered to account for these facts: the velvet bean possesses a genetic factor *K* which is absent in the other three parents, but replaced by a similar factor *L*; the presence of either *K* or *L*, but not both is essential for the development of perfect pollen grains and embryo-sacs. The F_1 hybrids are therefore represented by *Kk Ll*, and will give rise to 4 types of pollen grains and ovules represented by *KL*, *Kl* *L*, *kl*. Of these *Kl* and *kL* correspond to the parental types and will develop normally, whilst *KL* and *kl* will abort. Thus in the F_2 generation we have the homozygotes *Kl Kl* and *kL kL* representing the parental types again and the heterozygotes 2 *Kl kL* giving, a ratio of 50 per cent of normally fertile progeny to 50 per cent semi-sterile.

161 – **Spore Conditions in Hybrids and the Mutation Hypothesis** (1). JEFFERY, EDWARD C., in *The Botanical Gazette*, Vol. LVIII, No. 4, pp. 322-335 + 3 plates. Chicago, Ill., October 1914.

It has long been recognised that sterility, partial or complete, is associated with hybridism. Evidence of this is found throughout the vegetable kingdom, but especially among the Angiosperms where the condition is easily recognised by the imperfectly developed pollen grains.

In many species of plants, especially among the *Rosaceae* and *Onagraceae*, the condition of imperfect pollen grains is found to be the same as in the case of well-recognised hybrids. Such species should be regarded as concealed or crypt-hybrids.

Thus, many species of *Oenothera*, *Epilobium* and *Fuchsia*, judging from the organisation of the pollen, are crypt-hybrids.

It is therefore of great importance that any investigations on the genetic behaviour of such species should be regarded as very inconclusive, especially in regard to the question of the origin of species by mutation.

A similar relation between hybridisation and mutation from the zoological standpoint has been recently pointed out by GEROULD (*American Naturalist*, Vol. 48, No. 570).

AGRICULTURAL SEEDS

162 – **Seed Tests made at the New York Agricultural Experiment Station during 1913.** — MUNN, M. T., in *New York Agricultural Experiment Station. Bulletin* No. 378, pp. 113-117, Geneva,, N. Y., 1914.

Inspection of agricultural seeds during 1913. — During the year, 292 official samples of seeds were drawn from dealers' stocks by authorized representatives of the Commissioner of Agriculture. Analyses of these samples showed 17.5 per cent to be violations of the said law, *i. e.* they contained in excess of three per cent by count of foul or foreign seed (2) and were not so labelled.

Lawn grass and grass seed mixtures were the most frequent violations, with alsike clover, red clover and red-top grass. The present law does not require freedom from dodder or other noxious seeds or from inert matter, and thus affords only a partial protection to the purchaser.

Voluntary examinations of seeds for correspondents during 1913. — From correspondents 975 seed samples were received during the year and examined. The greater proportion of the samples were those of alfalfa, with timothy and red clover coming next in number. These voluntary examinations revealed approximately the same conditions regarding the purity of the seed upon the market as the examinations made during the preceding year.

(1) See also *B.* July 1914, No. 615. (*Ed.*).

(2) Assembly Bill No. 628, constituting chapter 59 of the Laws of 1914, became a Law on March 20, 1914. It amends Section 340 of the Agricultural Law in relation to seeds, and changes the method of determining the percentage of foul or foreign seed from « count » to « weight ».

163 – **Impurities in Seeds in Victoria, Australia** (1). — *Communicated by* S. S. CAMERON, *Director of Agriculture.*

Report on seed examined in August and September 1914.

Kind of seed	Country of origin	Weed seeds: Species	Weed seeds: Percentage	Percentage of non germinable seeds	Percentage of diseased seeds	Quantity examined
Mixed grass seeds: rye-grass (*Lolium perenne*), white clover (*Trifolium repens*), suckling clover (*T. minus*). *	New Zealand (2)	*Cuscuta* sp.	0.008	*nil*	*nil*	3 oz.
		Rumex crispus	0.04			
		R. acetosella	0.19			
		Anagallis arvensis	0.20			
		Silene gallica	0.09			
		Hypochoeris radicata	0.29			
		Spergula arvensis	0.13			
		Festuca bromoides	0.33			
		Bromus hordeaceus	0.008			
White clover (*Trifolium repens*). **	Germany	*Rumex acetosella*	4.6	*nil*	*nil*	1/2 oz.

* This sample contained also 0.01 per cent of ergot (*Claviceps purpurea*) and a small percentage of grit and dirt. The consignment was returned to country of origin.

** This sample contained also a small percentage of loading. Returned to country of origin.

CEREAL AND PULSE CROPS

164 – **Wheat Breeding in Australia** (3). — RICHARDSON, A. E. V. (Agricultural Superintendent) in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XII, Part II, pp. 644-655 + 1 plate + 5 figs. Melbourne, November 1914.

The present annual production of wheat in Australia, in round numbers approximates 100 million bushels, grown on an area of 8 million acres. This crop, however, could be enormously extended.

As for the rainfall, the continent of Australia may be divided into three more or less concentric zones, each containing about one million square miles, namely :

1. — The high rainfall belt, 20 inches and over.
2. — The intermediate belt, over 10 inches and under 20.
3. — The low rainfall belt, under 10 inches.

Excluding the tropical portion, these areas correspond roughly to 1) the Dairying Belt, 2) the Wheat and Sheep Belt, 3) the purely Pastoral Area.

(1) See also *B.* 1914, Nos. 516, 619 and 724.

(2) See original article: The Grass and Clover Seed Industry in New Zealand, by A. H. COCKAYNE. — *B.* Nov. 1914, pp. 1385-1391.

(3) See *B.* Jan. 1915, No. 29. (*Ed.*).

In South Australia the margin of cultivation has already been extended to the 10-inch isohyete, and profitable wheat cultivation is now carried on in districts with an annual rainfall of under 10 inches.

Even if this isohyete represented the ultimate limit of profitable cultivation, there would still be vast areas in each State enjoying a much better rainfall that could be devoted to extension of the industry. Thus in the four wheat States : New South Wales, Victoria, South Australia, and the southern portion of Western Australia, there are 200 million acres of land lying between the 10-inch and 20-inch isohyetes, only a small portion of which has been brought under the plough, and which is well suited for wheat production. Indeed in New South Wales and Western Australia the greater part of the area lying between these isohyetes is still held under pastoral conditions. Moreover, in the wheat areas of the Southern States, 75-80 per cent of the total rain falls during April to October — the growing period of the wheat, and when the losses by evaporation from the soil are at a minimum. But for the fullest utilization of the semi-arid lands the production of *hardy, drought-resistant, prolific wheats* suited to the climate is essential.

With few exceptions, the varieties of wheat grown in Australia are not well suited for arid conditions. They have for the most part been introduced from the humid countries of the Old World. Many of these are varieties containing a high proportion of leaf and straw to grain and maturing too slowly. Varieties which show the greatest xerophytic capacity under Australian conditions are the short-strawed, narrow-leaved, spare-stooling, early-maturing types (ripening before the hot winds of spring set in), bearing a high proportion of grain to straw.

New and valuable varieties of wheat may be obtained in three ways : — 1. The isolation of prolific mutants. 2. The introduction and acclimatisation of wheats grown in foreign climes. 3. The production of new varieties by hybridising.

Among a large number of varieties obtained by isolation of mutants may be mentioned Marshall's No. 3, Steinwedel, King's Early, Gluyas, Petatz Surprise, and Dart's Imperial, which are largely grown in the drier wheat areas. The latter has retained its original characteristics for over 30 years and is still one of the best.

During the past seven years several Russian, Indian, Mediterranean and Durum wheats have been experimented in Victoria and South Australia. It has been found that whilst the majority of these varieties rarely do well under Australian conditions the first year or two, they nevertheless adapt themselves to the new environment. This may be accounted for by the fact that the individual plants of a given variety differ considerably from each other in their capacity to resist drought, and, consequently, increased powers of drought resistance under ordinary field conditions would result from the increase in the number of resistant types from year to year. Turkey Red, Kubanka and American 8 may be mentioned as varieties of this class of recent introduction which have been grown on a considerable scale.

The first place in Australian wheat breeding belongs to the late WILLIAM FARRER, to whom are due varieties like Federation, rust resistant, early and the most prolific wheat in the Commonwealth at the present day; Bobs, Comeback, Cedar and Rerraf, varieties of the highest milling excellence, which are quoted at 2*s* to 5*s* per quarter above ordinary varieties; Florence and Genoa, bunt-resistant types; Bunyip, Firbank, Cleveland, Bayah, etc. Other prominent workers in the prodution of new varieties by cross-breeding are PYE of Dookie Agricultural College, MARSHALL and CORREL of South Australia, and SUTTON and BERTHEAD of Western Australia.

The four wheat States of the Commonwealth have embarked on an active policy of cereal breeding. In New South Wales the bulk of the work is carried on at the Cowra Experiment Farm and the Hawkesbury Agricultural College, and various Experiment Farms are used as testing stations for the newly evolved types. In Victoria, cereal breeding forms a prominent feature of the work at each of the Experiment Farms and the Dookie Agricultural College. In South Australia, much attention has been given to wheat breeding at the Roseworthy Agricultural College, at the Experiment Farms, and by private breeders.

The work at the Wheat Breeding Stations comprises :

1. Testing and acclimatisation of introduced foreign types.
2. Selection of qualitative and quantitative variations.
3. Cross-breeding and general research work.

By means of systematic selection, several improved varieties have already been obtained. Thus in South Australia PERKINS has produced from King's Early Wheat two distinct types—the white and the red variety — both of which are extensively grown under the names of King's White and King's Red. In New South Wales PRIDHAM has obtained a strain of Federation wheat containing hard translucent endosperm from the soft-berried type.

A considerable amount of work has been done to improve the standard of prolificacy of Australian varieties by processes of continuous selection. In South Australia PERKINS has succeeded by this means in increasing the productiveness of several varieties.

In order to avoid, in this work, that the chosen plants are not merely high variants in a population of low mean values, a system of Centgener plots and mass selection methods for the progeny is, in a certain measure, successful.

The method of selection now employed at the Experiment Station, Rutherglen, Victoria, is to sow, for each variety tested, a number of plots containing 144 seeds from each selected plant at a uniform depth in a square, 12 seeds each way, by means of a specially constructed centgener planter. At harvest the outside rows are removed, and the central hundred plants used as a register of the prolificacy of the original selection.

Selected progeny of the most prolific selection, as determined in Centgener plots, is sown on a " Selection " plot of one-twentieth of an acre, and each year the prolificacy is maintained by the repeated choice of the

elite plants. The produce of the " Selection " plots passes automatically to the " Seed " plots, which in turn furnish the seed for the main farm areas. The effectiveness of this method of selection is shown by the fact that eight varieties of wheat subjected for three consecutive seasons to such methods have given increased yields ranging from 14 per cent to 38 per cent.

This system of Centgener plots is also being used at Rutherglen to determine the extent to which quantitative variations are inherited within pure lines and the effect of various environmental influences on the coefficient of variation and the coefficient of heredity.

During the last seven years a large number of crosses of prolific local types and certain introduced varieties have been made by the writer. When fixed, these crosses were sown in long rows side by side with standard varieties like Federation and each year the least prolific types were eliminated . After repeated trials, out of a large number of crosses brought under trial, a number of types of high yielding-capacity have been isolated, and in nearly all cases the crosses proved to be made from certain Indian varieties on Australian varieties like Federation, Comeback, etc. These Indian types, used as pollinating parents, were in nearly all cases early-maturing varieties, remarkably short of stature, with a high ratio of grain to straw, and with spare stooling habits.

During the last season several of these new crossbreds (when tried for the first time in small field plots) gave increases over the Federation check plots up to 46 per cent, whilst a number gave yields exceeding those of the parents from which they were derived.

165 – **Burgoyne's Fife Wheat in New Zealand**. — *New Zealand Department of Agriculture, Industries and Commerce: The Journal of Agriculture*, Vol. IX, No. 3, pp. 185-186. Wellington, N. Z., September 21, 1914.

Burgoyne's Fife Wheat, a variety introduced from Cambridge, England, has been tested under New Zealand conditions for several seasons at the Ruakura Farm of Instruction and at the Moumahaki Experimental Farm. The results show that the decided economic value of the wheat in the country of its origin is very much the same in New Zealand. During the last year (1913-14) at Ruakura it followed potatoes. The land was ploughed in autumn, left fallow during winter. In August it was again ploughed and was several times cultivated and harrowed. The seed, with 1 ½ cwt. each of superphosphate and bone dus, was drilled in on August 29. It received no treatment for smut, but there was no trace of this disease in the crop, which attained a height of 5 feet. It was cut on January 13 and yielded 41 bushels per acre, notwithstanding the bad weather and the attacks of small birds.

The grain, which threshed easily, was small, hard and of fine quality. This is one of the best rust-resisting varieties of wheat under trial at this station.

At Moumahaki it attained the height of 4 ft. to 4 ft. 6 in. and yielded 39.67 bushels per acre. A portion of the crop was cut green and made excellent fodder.

166 – **The Practical Value of Selected Hungarian Wheats** (1). — GRÁBNER, EMILE, in *Köztelek*, Year 24, No. 79, pp. 2761-2762. Budapest, December 21, 1914.

The work of selecting Hungarian wheat, begun by the Royal Hungarian Plant-Breeding Institute at Magyaróvár in 1905, has now assumed large dimensions ; a number of pedigree types have been produced, characterised chiefly by marked rust-resistance and heavy yield. The problem as to which are the most suitable districts for each variety has still to be worked out. In 1913-14 the Institute continued the work of arranging trials of pedigree wheat in cooperation with farmers in various regions ; a long series was carried out with a selected wheat from Arpádhalom (Csongrad county, in the Alföld).

Out of 139 farmers who had promised to collect data on the field value of these varieties, only 40 were able to send in precise results. On 28 farms the increase over the yield of the unselected wheat was considerable, while on the other 12 there was no difference ; 5 of these latter reported no superiority in quality, but in the rest the evenness, rust-resistance and strength of straw were remarked on. These reports come not only from the Alföld, but from the right bank of the Danube, from the mountains and from the north-eastern counties, thus showing that types selected in the Alföld, especially if of a hardy character, may do better in the country surrounding the Plain than on the Plain itself ; the result of selection depends more on the cultural conditions of the various farms than on the district.

A table of the yields shows that the increased crop given by the pedigree strains varied from 6 lbs. to 900 lbs. per acre. Thus a careful choice among the best selected varieties, combined with careful cultivation, may increase the yield of wheat in Hungary by one-half.

167 – **New Wheats obtained at the Rieti Wheat-Breeding Station, Italy.** — *L'Italia agricola*, Year 51, No. 12, p. 544 + 1 fig. + 1 col. plate. Piacenza, December 15, 1914.

Two new winter wheats obtained at the Rieti Station have been named Carlotta Strampelli and Gregor Mendel.

Carlotta Strampelli is from a cross of Rieti × Massy ; the stems reach 4 ft. 6 in. in height ; ear white, smooth, with long and strong beards; average bushel-weight 62.7 lbs. ; gluten content 11.9 per cent. In the Rieti valley this wheat has given 61 bushels (of 60 lbs.) per acre several years running. On milling it gives 79.4 per cent of flour of excellent baking quality.

Gregor Mendel is type No. 133 of the cross Rieti × Principe Alberto, of which 256 types have been raised. It is perfectly resistant to attacks of rust in the Rieti valley, which is very damp and subject to mists and heavy dews in spring and summer ; here it constantly gives more than 52 bushels per acre and does not lodge. The stems average 4 ft. 9 in. in height ; bushel-weight 62.4 lbs. ; gluten content 11.26 per cent. The flour passing a silk sieve (0.15 mm. mesh. = 170 to the inch) reaches 74 per cent, while the bran and pollards amount to 20 per cent.

(1) See also: *B.* 1912, Nos. 325, 326, 651; *B.* 1913, Nos. 353, 1333; *B.* 1914, Nos. 223, 324, 323 ,421. (*Ed*).

168 - **Experiments on Topping Maize.** — SACCHI, ACHILLE, in *L'Agricoltura italiana* Vol. XI, No. 782, pp. 705-707. Pisa, December 16, 1914.

Though topping maize too early, and still more stripping the leaves reduces the yield of grain, it appears from experiments carried out in the province of Treviso, Italy, that topping at the second node above the cob when pollination is complete does very little damage; as a good quantity of green food is obtained in this way, the practice may be recommended. The average of four experiments, made in 1912 and 1913, gave the following results:

	Grain, bu. per acre
Maize topped at the first node above the cob	35.2
» topped at the second node above the cob	37.4
» not topped	38.0

STARCH CROPS

169 - **Vegetative Variation in the Potato. — Storage of Seed Potatoes.** — MARTINET, G. (Chief of the Federal Seed-control and Experiment Station at Mont-Calme, Lausanne) in *Annuaire agricole de la Suisse*, Year 15, Part 2, pp. 242-253. Berne, 1914.

Vegetative variation. — Although varieties of potatoes constantly reproduced by tubers are generally known to be subject to a gradual degeneration, well-marked vegetative variations are rarely reported. Certain cases of change in the colour of potatoes may possibly be due to graft by approach between two varieties grown next one another: the writer has succeeded in obtaining such changes in the colour of the tubers by grafting, provided the vascular systems of the tuber and the graft succeeded in uniting.

Other observations have shown that a variety is particularly liable to variation during its first years, before it has become thoroughly fixed. Thus, at the Mont-Calme Experiment Station, the variety Kernours gave seven types differing in characters of haulm and tuber and in earliness after three years of cultivation. Another case observed at the same station was a modification of the variety Mission, grown from seed: in 1903 one tuber showed a purple spot round an eye. The tuber was divided into two parts, one white and the other containing the purple spot, both of which were planted in 1903; the latter gave one shoot with white flowers and several with purple flowers, while seven tubers were purple and the rest wholly white. The purple type was kept under observation for several years, during which it remained constant.

Other variations, not directly observable, may affect the yield, the disease-resistance, the shape of the tuber, etc; in these cases the variety may become improved or degenerate. Such a case was noted at Mont-Calme with Belle de Bourgogne, a new purple-tubered variety. After the seed-potatoes had been selected in 1901 from the most productive and healthy plants a still better plant was noted; its tubers were kept separate as a super-selection. In 1902 the super-selection gave a yield 33 per cent greater than that of the first selection, while the tubers were of better shape; the superiority was subsequently maintained. It thus appears that selection of seed-potatoes from the best plants tends to improve the qualities of a variety.

Storage of seed-potatoes. — Trials have been made as to the comparative value of seed-potatoes stored in cellars at Bullet (1150 m., = 3770 ft.), Chalet-à-Gobet (860 m., = 2820 ft.) and Mont-Calme (570 m., = 1870 ft.); the temperatures of the three cellars were respectively 1 to 2° C. (34 to 36° F.), 2 to 4° C. (36 to 39° F.), and 8 to 12° C. (47 to 54° F.). The potatoes from the two higher cellars appeared quite fresh in spring, while those from Mont-Calme were often wrinkled and sprouted. Extensive trials at Mont-Calme and Chalet-à-Gobet have shown that both on the mountain and in the plain the seed-potatoes from higher altitudes give better results. Besides the general superiority of seed-potatoes grown under mountain conditions, it should be noted that at high levels the varieties do not seem subject to degeneration, certain old varieties being still grown in the Swiss mountains

170 – **Influence of Potash on Rape.** — LONSDALE, T. W., in *New Zealand Department of Agriculture, Industries and Commerce: Journal of Agriculture*, Vol. IX, No. 4, pp. 250-252. Wellington, N. Z., October 20, 1914.

The experiments were conducted at the Moumahaki Experimental Farm. One acre of rape was manured with 2 cwt. of superphosphate and another acre with 2 cwt. of superphosphate and 56 lbs. of sulphate of potash.

On the 13th of March thirty-eight lambs were weighed and nineteen turned into each plot. On March 26 the lambs were again weighed. The lambs were an even lot and when additional stock was placed on the rape, plot 2 carried double the number placed on plot 1. After grazing down the second time the plots were closed and allowed to remain till the following August. The effect of potash was most remarkable, plot 2 having made vigorous growth during the winter, while the plants on plot 1 appeared weakly and were running to seed.

On January 20 fifty-nine sheep were turned into the respective plots and remained there till February 3. Though the difference in gain was not so striking as in the previous trials, in both instances potash has more than repaid the cost of the experiment, as is shown by the following table in which the gain in weight of the lambs is estimated at 3*d* per pound.

No. of plot	Manure	Cost of manure		Weight of lambs		Gain		Value of gain		
				at beginning of experiment	at end of experiment	per lamb	total			
		s	*d*	lbs.	lbs.	lbs.	lbs.	£	*s*	*d*
	1912-13									
1	2 cwt. super	10	0	1 064	1 148	4.42	84	1	1	0
2	2 cwt. super, 56 lbs. sulphate of potash . .	18	0	1 022	1 169	7.74	147	1	16	9
	1913-14									
1	2 cwt. super.	10	0	4 886	5 242	6.03	356	4	9	0
2	2 cwt. s per, 56 lbs. sulphate of potash . .	18	0	4 647	5 129	8.17	482	6	0	6

171 – **Root Crops and Recent Developments in the Root Seed Trade in Denmark.** — *Communicated by* D. HELWEG, *Danish Government Root Seed Commissioner.*

1. The cultivation of root crops for cattle food has had a remarkable development in Denmark during late years, as regards both the area and the yield.

	Area		Yield per acre	
	1897	1912	1897-1901	1908-1913
	acres	acres	tons	tons
Mangolds	83 900	206 027	17.0	21.2
Swedes and turnips	116 430	418 421	14.8	17.9

2. This great increase in the growing of root crops and in the yield obtained is the result of better cultivation, but also of producing such strains of the different kinds of roots as yield larger crops and roots of a higher feeding-value (greater percentage of solids, chiefly sugar). To encourage growers to produce still better strains, competitive trials have been carried on for a number of years under the control of the State. According to the results the strains are divided into three classes. The names of the growers of the best strains are published and seed of those strains is sold at high prices.

172 – **Experiments in Growing Carrots as Food for Stock at the Moumahaki Experimental Farm, New Zealand.** — HILL, W. S., in *New Zealand Department of Agriculture, Industries and Commerce: Journal of Agriculture*, Vol. IX, No. 4, pp. 235-244 + 2 figs. Wellington, N. Z., October 20, 1914.

The average of forty-one recorded crops of carrots harvested during 1913 and 1914 was 33.43 tons per acre. In the variety trials the following varieties (arranged in decreasing order of merit) were tested: Sutton's Matchless White, Hurst's Wiltshire Giant, Sinclair's Champion, Webb's New Mammoth White, Sutton's White Belgian, Hurst's Yellow Intermediate, Hurst's Merriott Green-top, Yates' White Belgian, Webb's Scarlet Intermediate, Sutton's Magnum Bonum, Hurst's St. Valery, Sutton's Improved Red, Carter's Hundred Ton, Lobberich's Agricultural, Carter's Orange Giant, Hurst's Altrincham, Hurst's James Intermediate, Carter's Red Elephant.

The maximum yield was 46.61 tons per acre and 41.47 of topped roots, the lowest being 18.08 and 14.94 tons respectively.

The efficacy of a dressing of 10 cwt. of salt (composed of a mixture of guano, superphosphate, sulphate of potash and sulphate of ammonia) six weeks previous to sowing was confirmed. The result of eighteen varieties was 28.92 tons per acre from the untreated plots, 32.81 tons from the salted plots and 36.49 tons from the plots that had been subsoiled and salted.

Of the white-fleshed varieties experimented with, Sutton's Matchless White has for two seasons given excellent returns. It grows rapidly with abundant foliage; it is easily lifted and lifts clean. White Belgian, Wiltshire Giant and New Mammoth White are heavy yielders.

Of the red-fleshed varieties, Sinclair's Champion has been a constant yielder for many years, the average yield for nine seasons being 33.64 tons per acre. This carrot was bred for field purposes in the Taranaki coast districts, the soil of which consists of a free loam overlying a more or less free and open subsoil; this land is very suitable for the growth of roots in general and especially for carrots for autumn and winter feeding of stock. It has the excellent characteristic of being easily lifted; it is an early maturer and contains a high percentage of dry matter. Other good red-fleshed varieties are Sutton's Magnum Bonum and the Barribal.

Among the yellow-fleshed varieties, Hurst's Yellow Intermediate and Sutton's Yellow Intermediate have been most constant.

Two varieties new to Moumahaki are Hurst's Merriott Green-top and Lobberich's Agricultural. These are heavy yielders, but lack quality.

The writer considers carrots at the rate of 10 lbs. per day per head as the best wool-, flesh- and bone-producing winter food for lambs he has yet used (he has, however, not yet used lucerne). In 1912 he kept forty woolly lambs per acre of carrots from April to September. The crop yielded at the rate of 51.94 tons per acre and was grown from 1 lb. of seed per acre in 14 in. drills. The result per head were as follows:

	£	*s*	*d*
Wool, 8 lbs. at 9*d*	0	6	0
Carcase	0	14	0
Gross return per head	1	0	0
Cost per head		8	0
Profit	0	12	0

Forty lambs per acre of carrots showed a profit of £ 24 per acre.

73 – **A Preliminary Note on the Factors Controlling the Ginning Percentage of Indian Cottons.** — LEAKE, H. M. (Economic Botanist to the United Provinces, India) in *Journal of Genetics*, Vol. 4, No. 1, pp. 41-47. Cambridge, June 1914. FIBRE CROPS

The ginning percentage, or the number of pounds of lint obtained from 100 lbs. of seed cotton, is of great economic importance in cotton-growing countries. In making it the subject of Mendelian study it is necessary to resolve it into its simpler component factors and to determine the degree of correlation of these factors with regard to each other and the ginning percentage.

It is obviously dependent upon the weight of the seed and the weight of the lint. The weight of the seed depends on the volume, specific gravity, and number of the seeds; the weight of the fibre depends on the number of fibres and the weight of the individual fibres, which in its turn depends on the length, thickness (mean diameter), size of lumen and specific

gravity of the substance of the fibre. The number of fibres depends on the number of seeds and the number of fibres on a single seed. It may also be determined from the number of fibres arising from a unit area of seed-coat surface, or the "density" of the fibres, and the total area of seed-coat surface, which in its turn is dependent on the volume of the seed. Thus, the weights of both seed and fibre are both directly affected by the same character — volume of the seed. The use of the "density" in place of number of fibres is open to objection, since the number of fibres is probably fixed early in the course of development of the ovule, while the volume of the seed, and hence the surface area and density, is in part determined later by the nutrition of the ovule.

From these considerations it is reasonable to suppose that the ginning percentage is the resultant of at least four characters as follows:

1) Volume of seed.
2) Specific gravity of seed.
3) Number of fibres arising from a single seed.
4) Weight of the individual fibres.

The method of determining these characters for a given variety of cotton is as follows: a healthy seed pod is selected and gathered after the capsule has expanded thoroughly and when the lint and seed are thoroughly dry. From this sample 2000 fibres are counted and weighed. The remaining lint is removed from the seed by a small hand gin and the weight of lint and seed, as well as number of seeds, recorded. The volume and specific gravity of the seed are then determined by displacement in water.

Since it was found that the fluctuations in the determination of the specific gravity are greater than the varietal differences, this character is eliminated by reducing it to the uniform figure of 1.10, involving a corresponding correction of the observed ginning per cent.

The volume of seed is expressed in cubic millimetres, the number of fibres per seed in thousands, and the fibre weight as weight of 1000 fibres in milligrams.

Preliminary determinations were made of 232 samples of Asiatic cottons. The data obtained covered a variation in ginning per cent of from 11 to 44 and showed no apparent direct relation between the ginning percentage and any of the remaining chracters.

The relation between the four characters: ginning per cent, number of fibres per seed, weight of 1000 fibres, and volume of seed, is expressed by the following formula determined by UDNY YULE:

$$\text{gin } \% = \frac{100\ k\ 1\cdot 1}{1 + k/1\cdot 1} \text{ where } k = \frac{\text{no. of fibres per seed} \times \text{weight of 1000 fibres}}{\text{volume of one seed.}}$$

Thus it is clear that the ginning percentage cannot be determined from any single one of the characters, but that the correlation between these characters requires determination.

These determinations were made and the results showed that the four characters formed a closely interrelated group in which variation in any

one character is fully accounted for by variation in one or other of the other three. The correlations between the ginning per cent and the other three characters are as follows:

Ginning per cent and	no. of fibres per seed	= + 0.7933
» »	wt. of 1000 fibres	= + 0.0530
» »	volume of seed	= — 0.2208

thus showing that the number of fibres per seed is the only factor having any marked effect on the value of the ginning percentage.

These experiments show that the determination of the ultimate causes of variation in the ginning percentage cannot be made directly, but must be sought in their effect on the three characters under consideration and especially on the number of fibres per seed.

Before this conclusion can be applied in practical plant breeding, the true value that can be assigned to any such character for a given plant must be determined. Sufficient information has already been obtained to show that individual variations are easily distinguishable from the difference found between different races.

174 – **On Certain Species of the Genus *Hibiscus*** (1). — MICHOTTE, F., in *Bulletin des Séances de la Société Nationale d'Agriculture de France*, No. 9, pp. 810-812. Paris, 1914.

The genus *Hibiscus*, belonging to the Malvaceae, is remarkable as containing a number of ornamental, medicinal, edible and industrial plants. The 60 species range from shrubs to trees and they grow in tropical and subtropical countries.

As edible species the following may be mentioned : *Hibiscus esculentus* or gombo, grown especially in Egypt, India and the United States, and *H. sabdariffa*, which is used in the United States and Australia for preserves and syrups.

The species *elatus*, *tiliaceus*, *macrophyllus*, *mutabilis* and *vulpinus* yield good wood, resembling that of the ash.

The bark of all the species of *Hibiscus* yields from 3 to 3.6 per cent of textile fibres, whilst jute gives only 1 per cent. Further, while jute requires a suitable soil and climate, *Hibiscus* grow well in all kinds of soil and under all warm climates.

In India about 3 700 000 acres are under *Hibiscus* : of this area 185 000 acres are in the province of Bombay and in the Punjab. The produce per acre of the different species is as follows :

	lbs.	
H. abelmoschus	980	
H. cannabinus	1 560 — 6 245	according to conditions of growth.
H. ficulneus	3 600	
H. gossypinus	3 600	
H. rosa-sinensis	5 400	

(1) See *B.* 1910, p. 69; *B.* Jan 1912, No. 106; *B.* May, 1913, No. 508. (*Ed.*).

The yield of jute reaches the lowest of the above figures. *Hibiscus* fibres and jute resemble each other very much, so much so that in India the two fibres are mixed together and it becomes impossible to distinguish one from the other.

175 – **Comparison between the Two Jute Plants (*Corchorus capsularis* and *Corchorus olitorius*).** — *The Indian Agriculturist*, Vol. XXXIX, No. 10, pp. 295-297. Calcutta, October 1914.

The seeds of *Corchorus capsularis* are about twice as heavy as those of *C. olitorius* and therefore require to be sown at twice the rate of the latter. The yield of seed from the two species is also in the same proportion. Both seeds are irregularly eight-sided in shape, but differ as regards colour, the former being uniformly brown and the latter being bluish- or brownish-green or brown according to the degree of maturity. Thus if a sample of *C. capsularis* seed contains any greenish seed it is mixed, but this is not necessarily the case with seeds of *C. olitorius*. The fruits of the former are round and much warted, those of the latter, long and cylindrical and much less warted.

In growth, the plants of *C. capsularis* develop more rapidly during the first three weeks but are gradually overtaken by those of *C. olitorius*, which sometimes attains a height of 18 feet, and which have much thicker and more uniform stems. In addition to tapering, the stem of *C. capsularis* has a tendency to branch before flowering, with the result that the uniform retting of the fibre is very difficult.

The leaves of the two species may be distinguished by the angle of the apex, that of *C. capsularis* being less than thirty degrees, whilst that of *C. olitorius* is nearer fifty degrees. The leaves of the former are also bitter to the taste and are used medicinally, whilst the latter are edible and used as a vegetable.

With regard to the quality of the two fibres, there is little difference, though that of *C. capsularis* has more gloss. Both fibres are used for almost the same purposes and some authorities consider the *Olitorius* fibre to be the finer and stronger (1). The percentage of fibre in *Olitorius* plants is remarkably constant among plants of 7 to 12 feet high, whereas in *Capsularis* the percentage rises with the height. The result of a series of analyses gave an average of 5.63 per cent of fibre in *Olitorius* without leaves and a percentage loss of matter in retting and drying of 78.6; in the case of *Capsularis* the averages were 5.33 and 85.50 per cent. The percentage of matter lost in retting and drying includes moisture and decomposition products and is greater in the case of *Capsularis* owing to the higher percentage of water in these plants. This is in agreement with the nature of this plant, which is more adapted to districts with a high rainfall than *Olitorius*.

(1) According to WATT'S *Dictionary of the Economic Products of India*, ROXBURGH found the fibre of *Capsularis* to be much stronger than that of *Olitorius*. (*Ed.*).

176 – **Manurial Experiments on Coconuts, 1913-14** (1). — VERTEUIL, JOSEPH DE, (Superintendent of Field Experiments) in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 83, pp. 267-276. Trinidad, August-October 1914.

CROPS YIELDING OILS, DYES AND TANNINS

This report deals with the third year's results of the manurial experiments on coconuts under the control of the Board of Agriculture. The experiments were carried out on three estates and included 5 series of 8 plots.

The results show that the application of manures was profitable in three plots only. It is concluded from these experiments that it is necessary to ascertain the natural yield of the coconut trees of each plot over a series of years before drawing conclusions as to the effect of any system of manuring or cultivation.

177 – **Some Changes in the Composition of Sugar Cane due to Premature Sprouting.** — HALL, J. A (Junr), in *The Louisiana Planter and Sugar Manufacturer*, Vol. LIII, No. 19, pp. 298-300 + 5 figs. New Orleans, November 7, 1914.

SUGAR CROPS

The material for these experiments was obtained from some plots of sugar cane which were attacked when about 4 or 5 months old during 1912 by the army worm (*Noctuidae*). Their growth being thus weakened they were allowed to remain uncut through the winter until the next year's harvest. Some only of the terminal buds were destroyed by the cold and in the following spring three distinct kinds of cane were produced: (*a*) suckers from the underground eyes, (*b*) plant canes with continuous growth from the terminal bud, (*c*) plant canes without terminal buds but with lateral shoots.

Chemical analyses were made of these three different canes and in addition the lateral shoots (*d*) of (*c*) were analysed separately. The analyses were repeated several times during the period March to July.

Contrary to expectation, the canes which had sprouted from their upper eyes showed a higher sucrose content and a higher purity than those of the same age that had not sprouted.

Some of the results are given in the following table:

Date.	Kind of Cane.	No. of Stalks.	Glucose.	Purity.	Ash in Juice.
April 7.	A	42	1.5	70.7	0.475
	B	60	0.4	85.9	0.306
	C	25	0.2	91.2	0.232
	D	59	1.0	78.3	0.332
April 30.	A	45	0.8	83.6	0.420
	B	65	0.3	89.9	0.295
	C	19	0.1	92.7	0.248
	D	36	0.7	86.4	0.350

(1) See also *B.* Dec. 1914, No. 1129. (*Ed.*)

These figures also show a considerable reduction in the ash content of the juice from canes bearing sprouts, owing to the mineral requirements of the sprouts.

Analyses of the juice of underground rhizomes were also carried out; they were found to contain 0.7 % of glucose and a purity of 78.2 %, the original purity of the cane being about 85 %. Considering that the stems had been underground for more than a year and a half and subject to pests, it is evident that the sprouting could not have had any very marked effect in lowering the purity.

Analyses of the juices of different varieties were also made and the following results obtained :

Variety	No. of Stalks.	Purity.	Ash in Juice.
Java 36	30	83.5	0.900
» 139	30	81.9	0.862
» 100	25	72.0	0.594
Manleica	25	72.5	0.693
Java 213	30	85.4	0.812
Honduras	25	80.9	0.676
Kavengire	30	82.9	0.974
Sumatra	10	84.7	0.551

Comparing the number of stalks with the ash content of the juice, there would appear to be some connection between the latter and the germinating or tillering power of the canes. This is what would be expected, since the young shoots must obtain their supply of mineral matter from the parent canes.

178 – **Average Yields of Beets and Beet Sugar in the Principal Countries of Europe for the Ten Years 1902 to 1912.** — *The International Sugar Journal*. Vol. XVI, No. 187, p. 307. London, July 1914.

Country	Factories 1912	Yield of washed, crowned and topped roots, tons per acre	Percentage of sugar	Sugar tons per acre
Belgium	74	11 20	14.35	1.61
Denmark	8	11.23	13.57	1.53
Germany	341	11.15	15.99	1.78
Italy	37	10.98	11.86	1.31
Spain	29	10.28	12.56	1.29
Sweden	21	10.80	14.90	1.62
France	220	10.32	12.96	1.34
Netherlands	27	10.37	14.84	1.54
Austria-Hungary	197	9.54	15.29	1.46
Russia	279	6.03	14.88	0.90

179 – **Production of Sugar in the United States, 1913.** — *United States Department of Agriculture, Farmer's Bulletin* 598, pp. 9-12. Washington, May 22, 1914.

The total amount of sugar produced within the United States proper from the crops of 1913 exceeded one million tons. In the previous year, owing to the crop failures in Louisiana, the sugar production of the United States proper was only about 855 000 tons, and two years ago this production amounted to 960 000 tons.

The average consumption of sugar in the United States for the two fiscal years beginning 1911 and 1912 was about 4 million short tons. The sugar of domestic production, that is of the United States proper exclusive of insular possessions, constituted 25 and 20 per cent respectively of the total supply.

Beet sugar constituted in 1913-14 71 per cent, and cane sugar 29 per cent, of the total domestic production. In the period from July 1, 1913, to June 30, 1914, 733 401 tons of beet sugar, chiefly refined, and 299 698 tons of cane sugar, chiefly raw, were produced in the country. To this latter quantity Texas contributed 7000 tons, Louisiana the rest.

In 1912 the amount of imports from foreign countries, less the exports, was 346 027 tons, and that received from Hawaii, Porto Rico and the Philippines, 1 018 979 tons.

The sugar-beet and beet-sugar production in the United States in 1913 is shown in the following table :

	Sugar made, chiefly refined	Beets used			Analysis of beets		Average extraction of sugar, percentage of beets
		Area	Production	Average price per ton	Percentage of sucrose	Purity coefficient	
	tons	acres	tons	$			
California	171 208	127 610	1 138 003	6.10	18.04	86.26	15.05
Colorado	229 274	168 410	1 840 653	5.67	14.92	84.01	12.46
Idaho	29 620	22 497	222 612	4.99	16.24	86.35	13.31
Michigan	122 424	107 965	955 242	5.93	15.82	82.61	12.82
Ohio	28 687	30 661	240 435	5.34	14.46	82.95	11.93
Utah	57 231	39 472	481 863	4.81	15.07	83.86	12.08
Wisconsin	12 553	11 800	114 000	5.80	14.10	—	11.01
Other States	82 404	71 591	666 654	5.66	14.99	81.89	12.36
United States	733 401	580 006	5 659 462	5.34	15.78	83.22	12.96

180 – **Manuring Experiments with Cacao in Dominica.** — TEMPANY, H. A. (Government Chemist and Superintendent of Agriculture for the Leeward Islands), in *West Indian Bulletin*, Vol. XIV, No. 2, pp. 81-119. Barbados, 1914.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

Two series of experiments on manuring cacao were carried out: the original series begun in 1901 and an additional series begun in 1906. The nitrogenous manure was applied in the form of dried blood containing 12

per cent of nitrogen, phosphoric acid as basic slag of 16 per cent strength, and potash as sulphate of potash at 50 per cent. These manures were tried separately and together. Experiments were also tried with a mulch of grass, leaves and the pods of *Pithecolobium saman* Benth. (at the rate of 100 lbs. per tree), containing as percentages of the air-dry matter: nitrogen 2.116, phosphoric acid 0.156 and potash 0.644. A parallel series of experiments was made using cottonseed meal as manure, containing nitrogen 4.5 per cent, phosphoric acid 1.2 per cent and potash 1.2 per cent. The arrangement of the plots and average results obtained are summed up in

Table I.

Plots.	Number of trees	Area in acres	Manurial treatment	Average yield of cured cacao, in lbs. per acre
				(1902-1913)
1	51	0.28	None	1190
2	64	0.29	Basic phosphate 4 cwt. Sulphate of potash 1 1/2 cwt.	1430
3	59	0.36	Dried blood 4 cwt.	1405
4	44	0.29	Basic phosphate 4 cwt. Sulphate of potash 1 1/2 cwt. Dried blood 4 cwt.	1653
5	49	0.37	Mulched with grass and leaves	1798
				(1907-1913)
6	46	0.25	Mulched with grass and leaves	1934
7	51	0.25	Cottonseed meal	1751
8	82 (74)	0.414	None	937
9	84 (78)	0.373	Mulched with grass and leaves	1612

These results show clearly the effects of the various forms of manurial treatment; the best result was given by the plots mulched with grass and leaves, while the plot with complete manure came next. Examination of the results for each year shows that under orchard cultivation a period of from three to five years will usually be required before the trees settle to the state of productivity conditioned by the treatment applied.

Analyses of the soils (which are light and sandy) show that on certain plots, particularly those mulched with grass and leaves, there is a considerable accumulation of nitrogen, probably due to bacteria of the *Azotobacter* type. Laboratory experiments suggest that, in view of the small content of calcium carbonate, the ammonia formed in the early stages may serve to neutralise the nitric acid formed later. A study of the soil moisture conditions indicates that while adequate covering and shading of the soil surface affect the moisture content of the upper layers of the soil

to a marked degree, none of the manurial methods practised have exerted any appreciable direct effect on the moisture-retaining properties of the soil.

With regard to soil temperature, shade has a very favourable effect in maintaining it almost constant at the value of the air temperature during the coolest portions of the day, which is very suitable to the delicate nature of cacao plants, at any rate when young. A study of the relation between the yield and rainfall shows that a very heavy rainfall tends to diminish the yield.

Owing to the importance of mulches in tropical agriculture, the analyses of some of the materials used for this purpose are given (see Table II).

TABLE II. — *Composition of mulch in percentages of air-dry material.*

	Andropogon caricosus L.	*Cymbopogon citratus* Stapf.	Mixed grass	Grass fo muleh	Clippings from *Gliricidia maculata.*	Pods of *Pithecolobium saman* Benth.
Moisture at 100° C.	13.42	13.03	9.97	10.83	11.69	16.80
Nitrogen	0.66	0.51	0.83	0.74	3.12	2.60
Phosphoric acid	0.04	0.37	0.22	0.22	0.40	—
Potash	0.97	1·16	0.80	0.99	—	—

181 – **Strain Tests of Tomatoes.** — MYERS, C. E., in *Pennsylvania State College, Agricultural Experiment Station, Bulletin* No. 129, pp. 139-150. State College, Centre County, Pennsylvania, 1914. MARKET GARDENING

This is a paper on an experiment instituted for the purpose of determining the relative values of strains of tomato seed from different sources, and conducted at the Pennsylvania State College, Centre County. Each lot of seed is designated as a strain.

In a preliminary test carried out in 1908, twelve strains each of the varieties Earliana and Chalk Jewel were tried. The next year twenty-eight strains of the former and twenty-six of the latter were secured, together with twenty-five each of Matchless and Beauty, twenty-four of Globe and twenty-six of Stone. These, as well as those secured in 1908, have been tested during the years 1909,1910 and 1911.

The results are set forth in the accompanying table. The comparison between the yields of the various strains of a variety at a given date allows their relative earliness to be determined. These determinations were made on August 15 for Earliana, Chalk Jewel and Matchless and on September 1 for the other three. The yield per acre given in the table is not that actually weighed, but is corrected so as to eliminate the influence of variations in the fertility of the soil.

Limits of variation of the various strains of tomatoes.

Variety	Years	Variation in: Weight of marketable fruit	Percentage of marketable fruit	Yield at fixed dates	Corrected yield
		lbs.		tons per acre	
Earliana	1908–11	0.22–0.25	74–80	1.68– 2.76	11.47–20.17
»	1909–11	0.22–0.29	77–86	1.77– 4.46	9 21–17.94
Chalk Jewel	1908–11	0.20–0.26	76–83	0.65– 2.78	11.38–18.21
»	1910–11	0.20–0.27	67–79	0.95– 2.20	12.01–21.05
Matchless	1908–11	0.21–0.27	79–81	5.56– 7.80	12.13–17.74
»	1909–11	0.21–0.30	67–82	2.25– 6 61	11.23–19.85
Beauty	1909–10	0.20–0 27	59–79	4.45– 7.43	8.16–17 47
Globe	1909–11	0.23–0.30	74–85	6.31–10 89	12.38–25.54
Stone		0.23–0.28	64–79	2.02– 6.01	10.50–17.84

Thus in these tests ample variations occurred. These differences must be attributed not to environmental conditions but to heredity, and afford another proof of what can be obtained by selection.

BIBLIOGRAPHICAL NOTE.

182 – *Junta Consultiva Agronómica: Avance estadistica de la riqueza que en España representa la producción media anual de las plantas horticolas y plantas industriales* (Statistics of the wealth represented in Spain by the yearly average production of horticultural and industrial plants). Madrid, Imprenta de los hijos de M. G. Hernandez, 1914 (1 vol. 466 pp. + 111 figs.).

This is an extract made by the "Junta Consultiva Agronómica" from the Memoirs published in 1911 for each of the provinces of Spain and containing what is strictly necessary to give information for each province on the following subjects: improvements introduced into horticulture and in industrial crops; the principal characters of each product; the prices reached; the greater or less earliness of the crop; the customary irrigations; the importance and destination of the exports; the effective value of the wealth they represent.

The volume consists of two parts, dealing with horticultural plants proper, and with industrial plants. In both, the summary referred to each province is followed by a table showing the area devoted in the province to each crop, and the average yield and value of each of them. At the end of the volume there are tables summarising the yearly average production of the various regions and a general summary for the whole of Spain.

FRUIT GROWING

183 – **The Best Varieties of Apples for Pennsylvania.** — STEWART, JOHN P., in *Pennsylvania State College, Agricultural Experiment Station, Bulletin* No. 128, pp. 109-13 State College, Centre County, Pennsylvania, 1914.

As the result of extensive experiments and observations bearing upon apple production conducted by the writer since 1907, in the course of which average productions of 500 to 600 bushels of apples were obtained over fiv

or six year periods, he treats of the methods to be followed by the average grower in starting and maintaining a successful apple orchard in Pennsylvania.

At the end of the Bulletin he gives a list of the varieties of apples most suitable for growing in the State.

A. Varieties for Southern Pennsylvania and lower altitudes in Central Pennsylvania.

Summer varieties.

" Yellow Transparent ". — Hardy, early bearer and productive, scab-resistant, but often subject to blight.

" Early-ripe ". — Blight resistant, stands shipping very well, early and satisfactory in bearing.

" Oldenburg " (Duchess). — Very early and regularly productive.

The above varieties are valuable commercially.

" Benoni ". — Excellent for dessert. " Starr ". — Early and prolific. ' Williams ". — Good for dessert and cooking. The commercial value of these three varieties is more limited than that of the first three.

" Early Harvest " and " Primate " are more suited for domestic use, as their fruit is excellent but they lack either in productivity or in hardiness.

Early autumn varieties.

" Summer Rambo ". — Suitable for commerce. Ripens over long season ; fruit large and attractive.

" Maiden Blush ". — Good for home or market.

" Wealthy ". — Good for the local market.

" Jefferis ". — Excellent for the home orchard.

Late autumn and winter varieties.

The following are suitable for commerce on a large scale :

" Smokehouse ".

" Rome Beauty ". — Bears unusually early.

" Ensee ", an apparent offshoot of the preceding variety.

" Stayman Winesap " is probably now being planted more than any other variety in south-eastern Pennsylvania ; its fruit is distinguished for its size, high quality and long keeping.

" York Imperial " is very productive but decidedly biennial. It is resistant to scale but rather susceptible to blight.

" Paragon " is a very late keeper of excellent appearance and of high quality.

" Mc Intosh ". — A very handsome and high quality apple but often subject to scab unless properly sprayed.

" York Stripe " a valuable variety.

" Grimes ". — Excellent fruit but very susceptible to collar blight or other trunk diseases.

" Jonathan " grows best on light soils; its chief fault is susceptibility to fruit spot, a physiological disease.

" Black Twig " or " Arkansas ", very similar to Paragon.

" Gano ", a strain derived from Ben Davis, produces excellent fruit, but it is very susceptible to injury by scale, curculio, and codling moth.

B. *Varieties for Northern Pennsylvania and the higher altitudes in Central Pennsylvania.*

Summer varieties.

" Yellow Transparent ", " Oldenburg " and " Williams ". — Varieties discussed above. " Red Astrachan ", a Russian variety suitable for the home orchard.

Early autumn varieties.

" Wealthy ", very suitable for commercial orchards. " Maiden Blush " and " Gravenstein " more suitable for local trade; the latter is unexcelled for cooking and is also good for dessert; the fruit is large but subject to loss by dropping. For the home orchard: " Chenango ", " Mother " and " Alexander ".

Late autumn and winter varieties.

For growing on a large scale: " Mc Intosh ".

" Northern Spy ". — Widely grown in northern Pennsylvania, especially in the higher altitudes. It is vigorous, and a regular and abundant bearer, but its fruit is susceptible to a soft rot unless properly handled at picking time.

" Baldwin ".

" Rome Beauty ".

For more local consumption: " Fall Pippin ", large and attractive fruit but rather susceptible to scab both in fruit and foliage.

" Hubbardston ", fruit large, good in quality and appearance, but the tree is extremely susceptible to borers.

" Smokehouse ".

" R. J. Greening ", valuable on heavy soils.

" Stayman Winesap ".

" Stark ", relatively free from disease. Its fruit often keeps until June in ordinary storage.

The following are more suitable for the home orchard:

" Twenty-ounce ", " Tompkin's King ", " Wagener ", " Esopus ", " Yellow Bellflower ".

184 – **Yields of Apple Trees at Different Ages.** — MACOUN, W. T. (Dominion Horticulturist), in *The Canadian Horticulturist and Bekeeper*, Vol. 22, No. 12, pp. 282-283. Peterboro', Ontario, December 1914.

Since the year 1908, or for sixteen consecutive years, records have been kept of the yields of over 3000 apple trees in the orchards at the Central Experimental Farm. From the above records the following data are taken:

The Mc Intosh apple comes into bearing the sixth year after planting at Ottawa, with twenty-two quarts of fruit, and increases up to the nineteenth year in which it yields seven and one-half barrels, after which it diminishes slowly. Taking the average for nineteen years, the yield per year from one tree was about two and three-quarter barrels.

The Duchess apple begins bearing the third year after it is planted, and the maximum crop so far has been reached in the twenty-fourth year, when a yield of over eight barrels was obtained from one tree. The average yield

from the third to the twenty-sixth year is about two barrels per tree, and from the tenth to the twenty-sixth, three barrels.

Wealthy is one of the earliest and most productive bearers, but it does not become a large tree. It begins bearing the second or third year after planting. The highest yield obtained from a Wealthy in one year was five and three-quarter barrels in the twenty-fourth year. The average yield per year from the third to the twenty-sixth year is about a barrel and a half. From the twentieth to the twenty-sixth year the average is two and three-quarter barrels per tree. This variety, as a rule, bears heavily one year and has a light crop the next (1).

185 – **A New Plum.** — TAYLOR, W. H., in *New Zealand Department of Agriculture, Industries and Commerce: The Journal of Agiculture*, Vol. IX, No. 4, p. 254. Wellington, N. Z., October 20, 1914.

The writer reports upon the satisfactory results obtained at the Arataki Experimental Farm (New Zealand) with the new Japanese plum Hermosillo. It is distinguished especially for its earliness. The first flowers opened on September 5 and the fruit was perfectly ripe on December 12. Its fruit is medium-sized, perfectly round, sweet and pleasant to the taste. It has, like most Japanese plums, a tough skin, and can thus travel in cases when quite ripe. It is a mistake to pack them green, as most of them become worthless after such treatment.

186 – **Recent Experiments in Shield-Budding Tropical Fruits in the Philippines.** — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. VII, No. 9, pp. 356-359 – 2 plates. Manila, P. I., September 1914.

The first essential in the improvement of fruit culture in the tropics is the application of vegetative means of propagation for the standardisation and fixation of superior types.

Budding experiments have been carried out during 1913 and 1914.

The durian (*Durio zibethinus* Lam.) and carambola (*Averrhoa carambola* L.) were very successfully shield-budded with the inverted "T" bud. The bud wood should be beyond the tender age and about 2.5 cm. long. Carambola and bilimbi (*Averrhoa bilimbi*) were unsuccessful when budded on each other and also the latter upon itself.

The buds of hevi (*Spondias cythereae*) should be selected from slender branches 7 to 10 mm. in diameter and should not be used until after the fall of the petioles and the formation of good leaf-scars. Since hevi is a rapid grower and calluses quickly, the buds should be cut large, and not less than 4 cm. long.

The atemoya (*Annona squamosa*) takes well on the mamon (*A. glabra*) and makes fairly rapid growth, though the custard apple (*A. reticulata*) seems more suitable and imparts to it a very characteristic upright growth. Budding on the soursop (*A. muricata*) is not successful.

Of Citrus fruits, the orange, mandarin, lime and pomelo have taken well on the calamondin (*Citrus mitis* Blanco) and made vigorous growth.

(1) See also No. 217 below. (*Ed.*).

The guava can be budded with success between November 1st and May 15th. The stocks should be budded as early as their size permits and as near the ground as convenient. The bud wood should be mature and without green bark and about 2.5 to 3 cm. long.

187 – **The Production of Citrus Fruits in Italy.** — CETTOLINI, S., in *Società degli Agricoltori italiani, Bollettino quindicinale*, Year XIX, No. 23, pp. 827-831. Rome, December 15, 1913.

The specialised cultivation of citrus fruits in Italy extends over an area of 114 700 acres, of which 80 600 acres are in Sicily, which produces an average of about 1210 million lbs. of fruit out of a total for Italy of 1650 million lbs. The remainder is produced in Calabria (more than 400 million lbs.), Liguria (26 million lbs.), Campania (147 million lbs.), Apulia (75 million lbs.), Sardinia (17 million lbs). The production of the other regions is negligible. The fruits exported come chiefly from the provinces of Messina, Catania, and Palermo.

TABLE I. — *Exports of citrus fruits and their products*, 1913-1914.

	1913.		1914 (first 9 months).	
Fruits.	Weight in lbs.	Value in £	Weight in lbs.	Value in £
Oranges	287 924 500	1 035 662	245 262 400	—
Lemons	671 397 000	1 932 007	581 640 900	—
Citrons	2 057 800	16 654	584 700	—
Products.				
Citrate of lime	—	240 379	—	328 680
Peel	—	49 005	—	62 504
Lemon and citron juice	—	15 566	—	9 250
Essence of orange	—	40 053	—	35 860
» bergamot	—	136 416	—	155 102
» lemon	—	667 886	—	671 836
» mandarin	—	1 991	—	1 960
Other products	—	1 519	—	509

Thus the total receipts of the citrus fruit industry in 1913 were £4 209 220, the greater part going to Sicily.

TABLE II. — *Exports during* 1913 *according to destination* (in lbs).

Country	Oranges	Lemons	Citrate of lime	Essence of orange	Essence of lemon	Essence of bergamot	Peel
Austria-Hungary	150 585 200	105 896 300	539 250	446 000	7 581 500	352 700	1 163 400
Russia-in-Europe	46 948 300	56 580 900	—	—	—	—	—
Germany	37 126 500	89 897 800	1 070 600	2 118 200	10 044 250	2 272 300	—
Great Britain	13 963 800	96 000 200	1 946 200	2 391 350	23 216 850	1 986 100	9 493 300
France	3 433 100	4 709 100	2 103 600	2 261 900	—	6 233 600	—
Belgium	—	8 824 400	—	—	—	—	—
Holland	—	5 695 600	185 200	—	—	—	—
Denmark	3 795 300	5 968 300	—	—	—	—	—
Switzerland	8 070 500	6 586 300	—	—	—	—	—
Turkey-in-Europe	1 266 800	13 491 200	—	—	—	—	—
Rumania	3 335 400	7 936 400	—	—	—	—	—
Malta	2 310 700	—	—	—	—	—	—
United States	4 947 600	244 941 700	2 561 100	2 619 089	42 618 600	2 213 000	—
Canada	1 452 000	6 078 600	—	—	—	—	—
Australia	—	4 529 400	—	—	3 575 700	—	—

The following are the principal ports receiving Italian citrus fruits and their products:

Austria-Hungary	Trieste, Fiume.	Holland	Amsterdam, Rotterdam.
Belgium	Antwerp.	Rumania	Constanza, Sulina.
Denmark	Copenhagen.	Russia	Batum, Novorossik, Odessa, Ordom, Sebastopol, Taganrog.
France	Marseilles, Nice.		
Germany	Hamburg.		
Great Britain	Glasgow, Liverpool, London, Manchester.	United States	New York.

188 – **The Productivity of European Vines on American Stocks.** — CETTOLINI, S., in *L'Agricoltura Moderna*, Year XX, No. 17, pp. 360-362. Milan, September 1914.

According to the effect on the growth and productivity of the graft, American vines may be divided into two groups: 1. those which immediately develop an extensive root system; 2. those which during the early period of their growth have only a moderate root system which extends gradually. With the first group well grown European vines give excellent results and with the second group the yield is poor at first but gradually increases. *Riparia* and *Rupestris* belong to the first group, and *Berlandieri* to the second.

The results in the following table were collected to test the influence of the stock on the productivity of European vines.

Average yield in lbs. per vine.

European variety	Variety of Stock			
	Riparia Grand Glabre	Riparia Gloire de Montpellier	Rupestris du Lot	Rupestris metallica
Monica	9.35	8.69	8.69	6.70
Appesorgia (white)	7.03	5.94	1.76	6.60
» (black)	8.36	6.16	5.72	6.88
Bovale (small)	3.82	2.15	2.20	4.18
» (large)	3.82	2.48	1.87	3.25
Barbera	6.93	3.52	1.43	6.82

	Hybrid Grimaldi 791	Riparia Gloire	Riparia × Rupestris	Aramon × Rupestris	Calabrese × Rupestris Grimaldi 110
Nerello Mascalese	4.409	2.002	2.904	7.26	2.574

The results given in the last line of the table were obtained in the strong lands of Catania on recently grafted vines ; those of the first five lines relate to Sardinian vines.

The influence of immediate grafting is felt not only on the quantity of production, but also on the quality of the must. The Sardinian grapes which furnished the greatest quantity of saccharine matter are Malvasia and Cannonau, which gave respectively :

Stock	Malvasia		Cannonau	
—	Glucose %	Acidity %	Glucose %	Acidity %
Rupestris metallica	26.5	9.8	25	6.9
» du Lot	26	10.5	26	7.5
Riparia Gloire	26	7.8	23	8.9
» Grand Glabre	25	8.3	24.5	6.5

The greatest quantity of sugar was found in Monica (16.5 to 17 per cent) and Galloppo (17 to 18 per cent).

With regard to the influence of the graft on the organoleptic qualities which cannot be determined chemically, wine produced from a grafted American vine does not differ appreciably from a wine produced by the same European vine ungrafted if the ungrafted vine comes from a recently planted vineyard in good condition. There is, however, a notable difference in favour of the ungrafted vine if the European vine comes from an old vineyard of average productivity. Generally it is only possible to compare the wines of two stocks when they grow under identical conditions of soil, cultivation, age, etc. The writer does not consider that

reconstituted vines are destined to a shorter existence than ungrafted vines merely owing to grafting, though it may be indispensible to their length of life that the higher requirements of the grafted vines are satisfied.

189 – **The Reconstitution of Vineyards on American Stocks in Italy.** — PAVONCELLI, GIUSEPPE (Report presented to the 44th. Italian Agricultural Congress, Florence, April 1914) in *Società degli Agricoltori, Bollettino quindicinale*, Year XIX, No. 15, pp. 583-600. Rome, August 15, 1914.

The data here given are in part the result of observations made by the writer, and in part drawn from or checked with the results of an enquiry conducted by the Federation of the Antiphylloxera Consortiums and by the Section of Vine-growers of the Society of Italian Agriculturists.

Phylloxera has now invaded about 2 million acres of Italian vineyards. In Italy also the protection of vine-growing went through the following stages: destruction of affected vines, treatment (when possible) with carbon disulphide, and reconstitution on American stocks. Chiefly at the initiative of the Ministry of Agriculture nurseries were set out with seeds imported from America, but as with the progress of phylloxera it became urgent to reconstitute large extents of vineyards and it was impossible to do so with vines originated from seed, the cultural character and resistance of which there had been no time to determine, it became necessary to have recourse to the importation of stocks which had already undergone selection in France, that is, "named vines". These were used for the numerous nurseries started first in the regions invaded by phylloxera (Sicily, Sardinia, Calabria and Elba), then in the Tremiti Islands, where for several years all the material to be distributed in the immune districts was kept under careful observation. (1)

The seedling vines (with the exception of *Riparias* which in suitable surroundings proved useful) dropped into the background; nevertheless they continued to be studied with the aim of creating hybrid graft-bearers which might advantageously replace foreign stocks. All attempts at producing direct-bearing hybrids failed, so they were soon limited to the collections of students.

The named stocks most employed in Italy were the following:

Riparia group: Rip. Gloire; Rip. Grand Glabre.
Rupestris group: Rup. du Lot; Rup. metallica; Rup. Martin.
Berlandieri group: Berlandieri × Resseguier No. 1; Berlandieri × Resseguier No. 2; Berlandieri × Lafont No. 9; Berlandieri × Lenée.
Riparia × *Rupestris hybrid group:* Rip × Rupestris 3306, 3309 and 101-14.
Berlandieri × *Riparia group:* Berlandieri × Rip. 420 A, 157-11 and 34 E.
Berlandieri × *Rupestris* and *Rupestris* × *Berlandieri group:* Rup. × Berlandieri 301 A, 301 B and 219 A; Berlandieri × Rup. 267 A and 13-37.
American × *Vinifera group hybrids:* Aramon × Rup. Ganzin No. 1; Mourvèdre × Rup. 1202; Chasselas × Berlandieri 41 B.
Other American × *American hybrids:* Rip. × Cordif. × Rup. 106-8; Solonis × Rip. 16-16.

(1) See *B.* March 1914, No. 246 (*Ed.*).

In *Sicily* for several years the only American stock that was grown was the Riparia obtained from seed (planted as far back as 1883 in the nursery of the Royal Agricultural Station of Palermo). It was set in the most varied soils, without accurate selection, which led to poor growth and early ageing, so that confidence in it was lost and as a result it was neglected even where the soil was suitable to it.

When the importation of stocks from France began, Rupestris du Lot and Aramon × Rup. Ganzin No. 1 spread rapidly. The hybrids Rip × Rup. 3309, 3306 and 101-14 were very popular at first, but their use was subsequently limited on account of their insufficient affinity with several local varieties. In planting the first two stocks, sufficient consideration was not given to their unsuitableness to certain soils ; some failures occurred, and it was unjustly said that Aramon × Rup. Ganzin No. 1. was not resistant to phylloxera ; of late years, however, it has been recognised that where the soil is suitable it remains vigorous. Likewise sufficient importance was not given to the fact that among the above-mentioned stocks Rupestris du Lot is the most susceptible to bramble-leaf (*roncet*). Among the hybrid stocks recently imported from France, Chasselas × Berlandieri 41 B is one of the best for calcareous soils. Among the hybrid stocks produced in Sicily, remarkable results have been obtained by Grimaldi's hybrids 446-525, 1257, 110, 722 ; Ruggeri's hybrids 42, 267, 333, 300 ; Paulsen's hybrids 1154, 1067, 775, 1742.

In *Sardinia* at first Riparia and Rupestris grown from seed were planted haphazard, and they showed unsatisfactory affinity with the local vines ; later the named vines were used and the following gave satisfactory results : Rupestris du Lot, Riparia × Rupestris 3309 and 3306 ; Rupestris metallica. The Macomer nursery has selected from seed a Rupestris of the metallica type wich has yielded very remarkable results. The Riparia Gloire and Rip. Grand Glabre have found suitable soils and the vines grafted on them have borne abundant crops during the last twelve years, without manuring. Recently the use of Riparias had diminished in favour of Riparia × Rupestris 3309 and Aramon × Rupestris Ganzin No 1, of which, as in Sicily, an excessive use was made. The Berlandieri hybrids were more sparingly used in the reconstitution of Sardinian vineyards, though Berlandieri × Riparia 420 A and 157 have done well in some localties and Chasselas × Berlandieri 41 B planted in soils which cause severe chlorosis has again confirmed its reputation as an excellent graft-bearing stock. Rupestris du Lot ; the Macomer Rupestris metallica ; Rip. × Rup. 3309 ; Aramon × Rup. Ganzin No. 1 ; Chasselas × Berlandieri 41 B and Berlandieri × Rip. 420 A have shown very satisfactory affinity with the local varieties.

In the Island of *Elba*, where phylloxera appeared in 1888, the stocks more frequently planted were Riparia Gloire, Rupestris metallica, and Riparia × Rupestris 3309, 3306 and 101-14. Rupestris du Lot was much used during the first years, but later it lost much favour, as it does not stand the drought in the granitic sands which prevail in the west of the

sland. In the calcareous soils frequent in the centre, Berlandieri × Ripa-ia 157 spread successfully.

In *Piedmont*, with the exception of the province of Novara, the recon-titution of vineyards is still in its initial stage. Good results have been btained especially with Rupestris du Lot; this has advantageously re-laced Riparia × Rupestris 3309, which does not possess sufficient af-nity with Barbèra.

In *Lombardy* the reconstitution of vineyards is also only beginning. n the province of Brescia and in the Valtellina good results have been btained from Riparia × Rupestris 3309 and Berlandieri × Riparia 20 A.

In *Venetia* phylloxera has been injurious especially in the provinces of Udine and Treviso. Reconstitution, however, has not yet proceeded on a ar with the mischief done.

In *Tuscany*, reconstitution has made progress especially in the pro-ince of Pisa (about 5 000 acres) ; next in order come the provinces of Flo-ence, Siena and Grosseto. During the first years Riparias obtained from eed were used, and proved successful where they found suitable soil. Next, he *numbered* stocks produced by the Royal nursery of Velletri and other nstitutions were tried ; among these Riparia No. 25 of Velletri yielded good esults, especially in clay soils. Lastly, the *named* stocks have been intro-uced, among which the best are: Riparia × Rupestris (especially 101-14), Rupestris du Lot, Rup. metallica, Aramon × Rupestris Ganzin, Berlan-ieri × Riparia 420 A, and Riparia × Cordifolia × Rupestris 106-8.

In *Apulia* there are 750 000 acres of vineyards, of which upwards f 150 000 acres are invaded by phylloxera, and only about one-eighth of his area has been reconstituted. In Apulia also the first step was the plant-ng of American vines obtained from seed (Riparia, Rupestris, and later Berlandieri) ; the next was the use of named varieties. The work of recon-tituting vineyards had to overcome special difficulties, due to the climate haracterised by severe droughts and great heat in summer, and to the ex-raordinary variety of soils. The stocks that have met with most favour re the Berlandieri hybrids, which show most affinity to the local vines ; hey are vigorous and drought-resistant. Four-fifths of the reconstituted rea is under Millardet's Berlandieri × Riparia 420 A ; the writer, how-er, observes that in the Apulian plain 34 E C has proved still more vigor-us, hardy and productive. The next in order of merit is Riparia × Rupestris 3309, which thrives especially in the rich, deep and damp soils ; n calcareous soils Berlandieri × Riparia 157 ; and in dry calcareous soils hasselas × Berlandieri 41 B. Aramon × Rupestris Ganzin No. 1, contrary o experience with it in Sicily, has found suitable soil in Apulia and has een successful. At present a number of Americo-American and Americo-Apulian hybrids are under trial.

190 – **Hybrids of European and American Vines in Sicily.** — CETTOLINI, S., in *L'Italia agricola*, Year 51, No. 11, pp. 485-487. Milan, November 15, 1914.

The American vines and their hybrids imported from abroad have rendered valuable service and continue to do so, especially in the valleys of the Po and its tributaries; but the conviction is gradually gaining more ground that for dry climates and soils the new vines obtained by crossing original American stocks with the local vines are the most suitable. In Sicily such hybrids have been under trial for the last ten years, and several of them have given good results.

Among the best of them the writer mentions the following: —

Grimaldi's hybrids. — *Berlandieri* × *Regano* No. 1257 adapts itself well to calcareous soils, even if they are dry and poor; it has a vigorous growth and the proportion of its cuttings which strike root attains 70 per cent; *Berlandieri* × *Rupestris* No. 444 and No. 446 have given fairly good results in calcareous soils, but they strike root with difficulty. *Calabrese* × *Rup. Ganzin* No. 88 and No. 110, and *Frappato* × *Rup. Ganzin*, with a high percentage of strikes (from 90 to 100 per cent), have been successful in clay loams and in calcareous sand, but they seem to be rather subject to bramble leaf. *Calabrese* × *Aramon Rup.* No. 940 and No. 953 have also given good results as direct bearers for common wines.

Paulsen's hybrids. — *Berlandieri* × *Ar. Rup.* No. 1043 and *Berl.* × *Rup. Martin* No. 1381 prefer a sandy soil, even if it is calcareous and with a tufaceous subsoil; they root freely (80 to 90 per cent); their yield is moderate at first and then it becomes abundant, good and constant. *Catarratto* × *Berl.* No. 2, countermarked No. 779, thrives best in deep and not very dry calcareous, sandy or clay soils, but it grows well also in calcareous sands; it is not a very good striker (50 per cent). *Berlandieri* × *Ar. Rup.* No. 1458 has a vigorous growth, and its eyes root well (100 per cent) in deep compact clay loams, and, up to now at least, it keeps well also in loose and dry calcareous soils with very calcareous subsoil. For compact clay loams *Berl.* × *Rup. du Lot* No. 1742 and *Catarratto* × *Rup. du Lot* No. 1902 are also suitable; they root freely in nurseries (100 per cent). The second is the result of selection among natural hybrids obtained by sowing Rupestris, and it thrives in loams. It is easily multiplied by eyes and by grafting.

Ruggeri's hybrids — *Berlandieri* × *Rup. du Lot* No. 140 grows very well in all calcareous soils; it vegetates luxuriantly and its cuttings root well; its grafts succeed splendidly. *Berl.* × *Rup. du Lot* No. 42 grows well in marls containing much calcareous material, even if they are damp, but it is not so advisable as No. 140 for the heavier calcareous clays; it roots and is grafted easily. *Berl.* × *Rip.* No. 199, No. 225 and No. 267 have a good area of adaptability but do not tolerate much lime; they withstand drought better them Riparias. *Albanello* × *Berlandieri* No. 19 withstands the attacks of phylloxera as well as the pure American stocks. It has much affinity with European vines; its cuttings root freely, its yield is regular and abundant, and it adapts itself well to soils which produce chlorosis and those which are liable to dry out.

Agreeing with DESMOULIN and VILLARD, the writer believes that for the present hybrid direct-bearers cannot be used for the production of fine wines, but that they can be advantageously employed for moderate-priced common wines of average quality.

191 – **The Development of the Cranberry Crop in Wisconsin.** — RICHTER, ALBERT EDWARD, in *The Country Gentlman*, Vol. LXXIX, No. 49, pp. 3-4, + 4 figs. Philadelphia, December 5, 1914.

The cranberry crop in the United States for 1914 was a record one, being estimated at 1 500 000 bushels against 1 210 000 bushels in 1913. Eighty per cent of this crop is produced in Massachusetts, New Jersey and Wisconsin, and owing to the efforts of the Wisconsin Experiment Station it is estimated that Wisconsin alone will yield half the total crop of the United States within the next 15 years. The cultivation is being placed on a scientific basis. Careful records of the temperatures above the soil are obtained by means of a thermograph and maximum and minimum thermometers. The daily weather charts from the United States Weather Bureau at Chicago are received and by controlling the water in the irrigation ditches the bogs can be flooded in anticipation of predicted low temperatures. By this means and the adoption of suitable methods of cultivation and spraying against insect and fungoid pests, the success of this cultivation is no longer precarious. The Searl bogs in Central Wisconsin, the best in the State, are about 28 acres in area. Twelve acres are planted with a variety of cranberry known as *Searl's Jumbo*, one of the largest cranberries grown and three to four times larger than the native fruit from which it was propagated. In 1909 this variety yielded 250 barrels (of 100 quarts) per acre. The average yield of these bogs during the past 7 years has exceeded 100 barrels per acre. In 1912, these bogs yielded 3000 barrels, which realised $ 19 500. Deducting $ 4 500 for operating expenses, there remains a net return of $ 15 000 or $ 536 per acre. Capitalised at $ 4000 per acre the Searl bogs will easily yield 12 per cent per annum. During 15 years these bogs have not failed once to produce a crop.

BIBLIOGRAPHICAL NOTE.

192 – JUAN PUIG Y NATTINO (Chief of the Chemistry Section of the Agricultural Experiment Station), *Estudios sobre la fruticultura nacional, 2ª Parte: Duraznos, Peras y Ciruelas* (Studies on national fruit-growing, 2nd Part: Peaches, pears and plums). Montevideo, 1914 (Boletin No. 13 del Ministerio de Industrias), 77 pp. + 3 plates + 135 figs.

In this second part of his studies, the writer makes some general considerations based on chemical and agricultural analysis in connection with the quality of fruits and the industries depending upon them; he next treats of the exportation and importation of fresh fruit from and into the port of Montevideo, giving information on the different kinds of packing used. He then gives physical and chemical data concerning 22 varieties of peaches, 10 of plums and 7 of pears. The appendix consists of one table with the results of the chemical analysis of the above fruits, one table giving the weight of the same fruits, and a series of 125 engravings of the transverse and longitudinal sections of the same.

FORESTRY

193 – **The Establishment of Forest Screens.** — FREY, in *Zeitschrift für Forst- und Jag wesen*, Year XLVI, pp. 572-575. Berlin, 1914.

The writer deprecates the use of spruce as a forest screen and point out its practical and economic disadvantages, in that from the beginning does not afford protection to the boundaries of the plantation from the win and sun; when it has advanced in growth, instead of being a protec tion against gales, it even increases the danger, since spruces are easil blown down. Shrubby trees are therefore recommended for the bound aries and the borders of paths.

When it is necessary to establish a screen after the first clearing, *i.* at about 25 to 30 years, a margin of from 6 to 12 feet should be plante with the following shrubs: elders (*Sambucus racemosa* and *S. nigra*), an dogwood (*Cornus sanguinea*); for the outer boundaries the following are pr ferred: blackthorn (*Prunus spinosa*), hawthorn (*Crataegus oxyacantha* hazel (*Corylus avellana*), alder buckthorn (*Rhamnus frangula*), etc. In th way the chief object of a screen is obtained, *viz.* the prevention of the harde ing of the soil and its maintenance in a state of moistness and loosene suitable to the development of the main stand. The following advantage are also obtained: *a*) improvement from the aesthetic point of view, a sul ject of general interest at the present time; *b*) improved protection agains pests by providing suitable cover for insectivorous birds, especially th warblers (species of *Sylvia* and *Phylloscopus*); *c*) encouragement of gam

194 – **North American Forestry.** – I. SOMERVILLE, W., in *Journal of the Royal Hort cultural Society*, Vol. XI, Part 1, pp. 1-6. London, 1914. – II. Our Wood Supply (fro United States Government Bulletins), in *The Journal of Geography*, Vol. XIII, No. pp. 61-63. University of Wisconsin, Madison, October 1914.

I. — *Pinus strobus*, the White Pine, was at one time the most impo tant timber tree in North America, but at present it only takes the thi place in the list of United States timber exports. It is widely distribute east of the Rocky Mountains, extending from Northern Ontario throug the St. Lawrence basin and southwards through the Alleghany and Appal chian Mountains to Tennessee and Georgia, where some of the largest pin are still to be found. This species was extensively planted in Europe du ing the last century, but its existence is now seriously threatened by *Per dermium strobi*; this made its appearance in the United States also in 19 and rendered necessary the adoption of energetic measures for its contr

All through Eastern Canada and a considerable part of the Easte United States, one meets with the Jack Pine (*Pinus banksiana*), whos distribution extends northwards almost to the borders of Alaska. It rare forms a large tree, seldom being more than 1 foot in diameter, but it grow readily in poor soils and furnishes a large quantity of useful timber, use for telegraph poles, railway sleepers, etc. Ten or twelve years ago it w largely planted in Germany on the poorest soils, but it has failed to ful expectations. *Picea rubra*, *P. alba* and *P. nigra* (Red, White and Blac Spruces) are very widely distributed in Eastern Canada and the Unite States, and furnish most of the wood that supplies the numerous pu mills.

West of Winnipeg, forests are unknown, the trees of the prairie region being largely confined to the river valleys. However, the Agricultural Department of Canada has, during recent years, stimulated the creation of shelter belts by supplying trees free of charge or at a merely nominal rate. One of the most important of the Government Nurseries is situated at Indian Head, which was practically treeless in 1905, but which is now surrounded by fine healthy plantations. The trees that give the best results in the prairies are Scots Pine, European Larch, Norway Spruce and Box Elder (*Acer negundo*).

Large numbers of the Lodge Pole Pine (*Pinus contorta*) are met with in the foot-hills of the Rocky Mountains. In the Rocky Mountains themselves, especially in the Yoho Valley, Kicking Horse Pass, round Lake Louise etc., *Picea engelmanni* predominates. In this region are seen long bare strips running straight up the mountain-side which are the lines down which the avalanches descend every summer, thus preventing trees from becoming established. In the neighbourhood of Lake Agnes, above 4000 feet, *Larix lyallii* occurs. It is a rather dwarf larch of little economic value. The larch occurring at low altitudes in Eastern Canada is *Larix microcarpa* (= *americana*), which never attains a large size, but furnishes a great quantity of useful timber. Since it grows better on marshy land than almost any other conifer, it is possible that it might be suitable for planting on bog land.

On the slopes of the Rocky Mountains and the Selkirk Ranges the species of *Pinus* are not very numerous, but *P. monticola* is fairly common. At high altitudes, one meets with *P. flexilis* and *P. albicaulis*, which never reach large dimensions. On the west of the Rocky Mountains the commonest trees are the western Hemlock (*Tsuga heterophylla albertiana*), *Tsuga mertensiana* (= *pattoniana*) and the Red Cedar (*Thuja plicata* = *gigantea*), which sometimes attains gigantic proportions and is used in the manufacture of roofing shingles. In the Eastern part of Canada *Thuya occidentalis* is used for this purpose.

Not far from the Pacific coast, one finds the Sitka Spruce (*Picea sitchensis*), but the most important tree along the Canadan Pacific slopes is the Douglas Fir. This species covers enormous areas in the Selkirks and on Vancouver Island, spreading northwards into the Yukon and southwards, through the western United States, as far as Mexico. At the present time little of this timber reaches Europe, the bulk of it going to China, Japan, Australia and the Cape. It is regarded as the most valuable of all the additions to the exotic trees in Great Britain, being practically immune to disease, and easily satisfied as regards situation and soil, provided this does not contain too much lime. It is as durable as larch and produces an average of 200 cubic feet of timber per acre per annum.

South of the Canadian boundary of the United States on the Pacific slope, one meets *Wellingtonia gigantea*, *Sequoia sempervirens*, *Abies nobilis*, *Pinus lambertiana*, *Pinus ponderosa*, etc. The American Western Larch (*Larix occidentalis*) spreads to some extent north of the frontier, but occurs

chiefly in the north-western United States, where it produces stems up to 250 feet high and furnishes very valuable timber.

While the north-west of America is noted for its wealth of conifers, the south-east of the United States produces the hardwood timbers. In the Great Smoky Mountains the principal species is the Tulip-tree (*Liriodendron tulipifera*). Here also are a great number of species of Oak, intermixed with Chestnut (*Castanea dentata*), Beech (*Fagus americana*) and species of Hickory, Ash, Lime, Horse-Chestnut and Black Cherry (*Prunus serotina*). The last named tree is nowhere abundant and is becoming scarcer. There are also a certain number of conifers, especially in the extreme south of the Appalachians, where some of the finest White Pine occurs; other trees are Canadian Hemlock (*Tsuga canadensis*), especially on the southern slopes, *Abies fraseri* (on the tops of the highest hills), and occasionally *Tsuga caroliniana, Pinus taeda* and *P. rigida*. In the swampy plains further south, are great areas covered with Pitch Pine (*P. palustris*) and Deciduous Cypress (*Taxodium distichum*).

II. — The amount of timber standing in the forests of the United States is valued at about 2 900 billion board feet, of which about 76 per cent belongs to private ownership, 21 per cent to the nation, and 3 per cent to the public (federal, state or municipal). About $^{5}/_{11}$ belongs to the north-west Pacific (Washington, Oregon, Idaho, and Western California) where the following trees predominate: *Pseudotsuga douglasii, Juniperus occidentalis, Pinus ponderosa, P. lambertiana* and larch. A little more than $^{3}/_{11}$ belongs to Louisiana, Mississippi, Arkansas, Florida, Texas, Alabama and a part of Carolina, Virginia and Missouri, where the predominant trees are: *Pinus echinata* (= *P. mitis*), *P. longifolia* and *P. taeda* (the wood of all three species is known as yellow pine), cypress, eucalyptus, oak and other hardwood species. The lakeland States contain about 100 billion feet of standing timber, represented chiefly by *Pinus strobus, P. banksiana,* and *P. resinosa* (= *P. rubra,* Red American Pine), species of *Tsuga, Abies balsamea, Fagus, Betula* and *Negundo.* The north-eastern States furnish the greater part of the spruce wood for paper making.

Almost all the national forests occur in the Rocky Mountains and the ranges parallel to the Pacific coast from Washington, Idaho, and Montana to Southern California, Arizona and New Mexico. Others occur in Arkansas, Florida, Nebraska, Michigan, Minnesota, Alaska and Porto Rico; fourteen States have demarcated their particular forest reserves.

The quantity of timber cut annually in the United States is about 43 billion feet, of which the North-West Pacific States furnish only $^{1}/_{6}$; the south-east Atlantic States about 45 per cent; the lake States, which were formerly the centre of the timber industry, at the present time furnish less than the north-west Pacific States. The wood-producing states were in the following order of importance in 1912: Washington, Louisiana, Mississippi, North Carolina, Oregon, Texas, Arkansas, Virginia, Wisconsin, Michigan, Minnesota, Alabama, West Virginia, California, Florida, etc. More than 37 per cent of the timber produced in the United States consists of yellow pine, and more than 13 per cent is *Pseudotsuga douglasii.* Washington

State produces most of the *Pseudotsuga douglasii* and *Juniperus occidentalis*; Louisiana most of the yellow pine, *Nyssa uniflora* (= *tomentosa*) and cypress; Mississippi, most of the poplar wood; Arkansas, most of the *Hicoria* (= *Carya*) and *Eucalyptus*; Wisconsin, most of the *Tilia americana*, birch and *Tsuga canadensis*; Michigan most of the beech, elm and maple; Minnesota, most of the *Pinus strobus* and Western Virginia most of the oak, *Liriodendron tulipifera* and chestnut.

In a normal year the consumption of wood in the United States is about 40 billion feet of timber; 90 million cords of fire wood; 135 million hewn railroad ties; 889 million posts; 3 ½ million telephone and telegraph poles; 1 686 million staves; 136 milllion sets of heading, 353 million barrel hoops; 3 300 000 cords of native pulp; 165 million cubic feet of round mine timbers and 1 250 000 cords of wood for distillation. The yearly growth of wood in the United States is estimated to average about 12 cubic feet per acre, and the consumption is about three times this rate.

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195 – *Annual Return of Statistics relating to Forest Administration in British India*, 1912-13. — Simla, Government Monotype Press, 1914 (1 vol., 27 pp. + 1 plate).

These statistics were formerly included in the Inspector-General of Forests' Annual Review of Forest Administration in British India. From 1910-11 only the Statistics have been published annually and the progress of Forest Administration in India will be reviewed quinquennially, commencing with the period ending with the year 1913-14 (1).

The following figures are taken from Statement I, relating to *Area of all forest lands*:

Year	Total area in sq. miles	Forest-area in square miles			Percentage of forests to whole area
		reserved	protected	unclassed	
1908–09	986 144	94 561	8 835	138 378	24.5
1912-13	1 024 435	96 867	8 492	133 564	23.3

The subsequent Statements are as follows: II. *Progress in Forest Settlement.* — III. *Demarcation and Maintenance of Boundaries.* — IV. *Forest Areas Surveyed and under Survey.* — V. *Progress in Working Plant.* — VI. *Expenditure on Communications and Buildings.* — VII. *Breaches of Forest Rules.*

Statements VIII and IX deal with the *Area protected from fire* and the *Causes of forest fires*, and may be summarised as follows:

(1) See *B.* May 1912, No. 807. (*Ed.*).

I.

Year	Area in square miles		Percentage of forests protected to total area of reserve	Percentage of failure to area attempted	
	Attempted	Protected		average of 5 yrs. to 1911-12	1912-13
1908–09	46 432	44 497	49.0	6.3	4.5
1912–13	51 659	49 833	53.3	5.2	3.5

II.

Year	Fires originating in Departmental Fire Conservancy operations		External fires crossing the Fire-traces		Fires due to carelessness of outsiders		Fires originating from intention or malice		Fires due to unknown causes		Total	
	No.	Sq. miles	No.	Sq. miles	No.	Sq. miles	No.	Sq. miles	No.	Sq. miles	No.	Sq. mile
1908-09	302	77	394	496.7	2 651	1 015.4	441	313.8	Included in fires due to carelessness		3 788	1 902
1912-13	227	79.8	409	212.7	870	207.5	206	392.3	1 531	999.4	3 643	1 891

The subsequent statements are: X. *Area closed and open to grazing* — XI. *Protection from cattle.* — XII. *Area of plantations and cost of the year's work.* — XIII. *Outturn of forest produce.* — XIV. *Forest produce removed by different agencies* (*Government, purchasers, free grantees, right holders*). — XV. *Exports of forest produce*: caoutchouc (raw), lac (button shell, stick, etc.), cutch and gambier, myrabolams, cardamums, sandal ebony and other ornamental woods, teak, other timbers; total value 1908-09, £ 2 708 015; 1912-13 £ 3 118 707. — XVI. *Estimated value of forest products given away free or at reduced rates.* — XVII. *Details of revenue and expenditure for the Forest year* 1912-13. — XVIII. *Summary of revenue and expenditure of the Forest Department in India for the financial year* 1912-13. — XIX. *Revenue, expenditure and surplus of the Forest Department throughout India* during 25 financial years from 1888-89 to 1912-13, from which the following figures are taken:

Year	Revenue	Expenditure	Surplus
	£	£	£
1888–89	927 230	541 984	384 579
1912–13	2 147 320	1 147 187	1 000 135

A diagram is appended illustrating the principal results.

LIVE STOCK AND BREEDING.

196 – **On the Effect upon Animals of the Spores of *Tilletia tritici* and *Ustilago maydis*.** — LISKUN, E., and KRASTAVIZKY, I., in *Bulletin of Applied Botany, Scientific Journal of the Bureau of Applied Botany* (monthly edition), Year 7, No 8. (72), pp. 508-526. Petrograd, 1914. HYGIENE

In order to determine their effect upon the animal organism, the spores of *Tilletia tritici* and *Ustilago maydis* were fed to guinea-pigs, mice, rabbits and a dog. Up to 10 gms. of spores were given daily to each animal.

During the time of the experiment, no injurious effects were perceptible, for all the subjects developed more or less normally. The *post mortems*, however, showed that all their organs were attacked by the spores and partially destroyed. The typical symptoms were hyperaemia of the digestive canal, dark or grey coloration of the mucous membrane of the intestine and stomach, and hyperaemia of the lungs, kidneys and brain. The spores accumulated especially in the adrenal bodies. The spleen was distinguished by being crammed with decomposed red blood corpuscles. The blood vessels were so full of spores that they sometimes burst from obstruction. The spores could still be seen in the organs from 22 to 43 days after they were fed to the animals.

In one case, the writers observed that they had penetrated through the placenta and reached the tissues of the foetus.

There was almost always a disproportion between the number of spores and the pathological changes.

The experiments thus show that the spores of *Tilletia tritici* and *Ustilago maydis* are injurious to animal organisms, though their effect may not always be visible externally.

197 – **Defects of Vision in Horses.** — MIECKLEY, ED., in *Zeitschrftt für Gestütkunde und Pferdezucht*, Part 12, pp. 241-247. Hanover, December 1914.

As a result of the frequent incorrect estimation of obstacles observed in the case of horses at jumping-competitions and the consequent hypothesis that these animals might be suffering from defective vision (faulty refraction of light), the sight of all the horses of the Royal Beberbeck stud was tested at the instigation of the General Secretary of the German Breeding Records Association (*Deutsche Gesellschaft für Züchtungskunde*).

The object of the whole proceeding was to determine whether horses which had been reared under the most natural circumstances possible, could suffer from such serious defects of sight, that their clearness of vision was thereby affected, and further, whether any such proved defects were hereditary.

The writer paid no attention to diseases of the eye due to periodic inflammation of that organ, but confined his observations to long and short sight and to astigmatism. By the last term is understood a change in the refractive power of the eye ; that is to say that in an astigmatic eye the rays from a focus do not reunite again, because the refractive power of the transparent medium (cornea, lens) is not the same in every possible

meridian ; thus, according to the degree of the astigmatism, more or less blurred pictures are thrown upon the retina.

The investigations were successfully carried out with Klingelhöffer and Holterbach's optical frames. The horses tested numbered 322, ranging in age from one to twenty years. The total results showed that 200 had normal sight, 90 were short-sighted and the rest long-sighted, or suffering from some other defect of vision. This gives on the average 28.13 per cent short-sighted and 6.52 per cent long-sighted horses. Both these types were thus fairly numerous, so the writer concludes that the statements that short-sightedness is exceptional and long-sightedness very rare are incorrect. It has also been found that the former defect is as prevalent in youth as in more advanced age, even if it is not more common; for out of 54 horses born in 1913, 16 were short-sighted and out of 106 broodmares only 29. The short-sightedness usually amounted to 1-2 dioptria (1) ; the long-sightedness also usually amounted to 1-2 dioptria, but once rose as high as 4. Only a few horses suffered from astigmatism.

In order to study the question of heredity, a special list was made of the members of a family of which the eyes deviated from the normal standard. It was found that in ten cases the short-sightedness of the dam reappeared in the offspring, while in only two cases did the foals inherit the long-sightedness of the dams. In other cases a short-sighted mare gave birth to a long-sighted foal, or to one with normal vision, and *vice-versa*. It is therefore premature to draw any conclusions as to the question of heredity ; it is, however, certain that defects of sight are present in early youth and are therefore congenital.

How far the discovered defects affect the use of the eyes, the writer could not decide. It is notable that the riding and driving horses, of which 11 had defective sight, showed no signs of abnormality in their behaviour.

198 – **The Cattle Testing Station of the Board of Agriculture and Fisheries.** — *The Journal of the Board of Agriculture*, Vol. XXI, No. 7, pp. 616-618 + 4 figs. London, October 1914.

The Board of Agriculture and Fisheries have founded an Official Cattle Testing Station, with the chief object of avoiding the risk of exporting valuable animals and then having them rejected or slaughtered by the importing colonies or foreign countries because they are found, on arrival, to be infected by disease.

This Station is situated at Pirbright, Surrey, and has accommodation for 100 head of cattle. Its work is at present confined to the testing for tuberculosis and to the immunisation of cattle against Red Water. Arrangements have been made with the Governments of Australia and the United

(1) By dioptria is understood the unity which serves as the basis for the calculation of refraction and which it was proposed by Donders at the Opthalmic Congress at Heidelberg in 1875 to take as one metre: this suggestion was adopted. It is a lens with a focal length of 1 metre.

States whereby their own agents test in the United Kingdom cattle intended for exportation to these two countries.

As for the immunisation against Red Water, the virus of this disease has been effectively maintained at the Board's Veterinary Laboratory for nearly nine years, and the strain has been reduced in virulence to the extent that it will not cause fatalities among the animals inoculated with it, but causes them only a more or less mild attack of the disease from which they recover without being seriously impaired in health. After recovery they are highly resistant to a second attack of the disease, whether an attempt is made to infect them by inoculation or whether they are exposed to natural infection. The time required for an animal to undergo the immunising process and be fit for shipment is from three weeks to a month.

Through the instrumentality of the Chief Veterinary Officer of the Board, 328 animals have been immunised and shipped to South Africa, Rhodesia, East Africa, Brazil and Argentina, and reports on these animals after landing in infected countries have been highly satisfactory.

A disease which is found in the same districts with Red Water, and which was at first confused with that disease, is Anaplasmosis, and if an animal contracts the two diseases together the results are often fatal. There is a certain amount of evidence, however, to show that animals which have previously been immunised against Red Water have a better chance of recovering from Anaplasmosis than animals not so immunised.

199 – **The Bacillary Pest, Typhus or Paratyphus of Young Pigs.** — COMINOTTI, LUIGI, in *La Clinica veterinaria, Rassegna di Polizia sanitaria e d'Igiene*, Year XXXVII, No. 23, pp. 989-1004 + 27 plates. Milan, December 15, 1914.

This disease has been described under the following names: "Voldagsenpest", after the locality, Voldagsen, where it was first recorded (DAMMANN and STEDEFEDER), typhus or paratyphus (GLÄSSER), bacillary pest or typhus (PFEILER), parapest (SCHERN and STANGE), paratyphus (HUTYRA, MIESSNER). It differs from the true swine fever in epidemiological, clinical, anatomical and pathological characters, and is considered by some writers as an idiopathic disease with very individualised etiology and by others as a secondary disorder resulting from the occasional pathogenic activity of bacteria associated with the filtrable virus.

The occurrence of paratyphus in Italy was first recorded by FAVERO in the province of Mantua, and it has occupied the attention of the Experiment Station for the Study of the Infectious Diseases of Live Stock at Milan since 1909. During this period the writer has carried out researches on: 1) the determination of the clinical, anatomic, pathologic and epidemiologic characters which distinguish paratyphus from swine fever; 2) the biochemical and serological behaviour of the bacteria isolated from the mesenteric ganglia of pigs, employing for comparison a culture of bacillus Voldagsen; 3) the virulence of the blood of pigs attacked by paratyphus, to determine if the bacillus cultivated by the writer was capable of producing the morbid symptoms observed, if the disorder could be transmitted to healthy pigs by contact and if the same symptoms occurred in pigs of the same age after ingestion of the bacillus of swine fever (*Bacillus sui-*

pestifer) : 4) means of immunisation against the infection of bacillus Voldagsen.

The chief results of the first group of researches were as follows : paratyphus is of enzootic origin ; it develops slowly from the beginning and never shows the real symptoms of a septicæmia of hœmorrhagic character ; it only attacks pigs less than four months old and its mortality is about 10-15 per cent. Swine fever, on the contrary, is infectious and generally develops the characters of a septicæmic fever or fever of the hœmorrhagic type, gradually taking the chronic form ; although it particularly attacks young pigs of 4 to 6 months old, it may also attack pigs of all ages and with a high percentage mortality. Clinically, paratyphus is distinguished by its slow development, accompanied by progressive emaciation, persistant diarrhœa, yellowish or greenish fæces, signs of cutaneous anemia, and generally persistent appetite. Swine fever, on the contrary, is not marked by any noticeable disturbance in the nutrition, diarrhœa alternates with constipation and the fæces are often mixed with blood ; it is also often characterised by hyperæmia and hæmorrhagic flooding in certain regions of the skin ; there is also sometimes complete loss of appetite. These differences, however, are not always constant.

From an anatomical and pathological point of view, the two diseases differ in the nature and situation of the intestinal lesions (in paratyphus they are found in the small as well as the large intestine) ; in the character of the inflammatory lesions of the lungs (often causing necrosis in the case of swine fever, but only local hepatisation in the case of paratyphus). A bacteriological examination is of great assistance in the differentiation of the two diseases, since the writer has never found in pigs attacked by swine fever, a bacillus with biochemical characters of the Voldagsen bacillus. Researches by means of serum are, on the contrary, of little use, because the blood of young pigs attacked by paratyphus has a very variable agglutinating power towards bacillus Voldagsen (from 1 : 800 to 1 : 20 according to the researches of the writer).

The writer draws the following conclusions :

1. There is also a bacillary disease of pigs in Italy of a morbid type having enzootic characters and a bacillus of the paratyphus B. group, and which, though distinguished by its epidemiological, clinical, anatomical and pathological characters from swine fever with a filtrable virus, has great affinity with it.

2. The Voldagsen bacillus which causes this form of the disease is distinguished from the swine fever bacillus by certain cultural characters and especially by determined biological characters.

3. The disease produced artificially in young pigs less than 4 months old by the ingestion of a culture of Voldagsen bacillus is transmissible by contact to healthy young pigs of the same age. Similar infection under the same conditions in pigs of the same age with the swine-fever bacillus is not transmissible by contact.

4. In small doses (2 to 5 cc.) the antivoldagsen vaccine does not protect the young pigs from infection by contact.

:00 – **Forage for Fattening Pigs.** — NETTLETON, W. D., in *The Country Gentleman*, Vol. LXXIX, No. 46, pp. 1848-1849. Philadelphia, November 14, 1914.

These experiments were carried out in 1913 by EVVARD and DUNN, f the Animal Husbandry Section, Iowa Agricultural Experiment Station, vith four lots of spring pigs averaging 30 lbs. initial weight during a period f 180 days in lucerne pastures.

TABLE I. — *Results of fattening pigs on lucerne with supplementary rations.*

Grain rations supplementary to pasturage (180 days)	Average daily gain lbs.	Cost of grain and forage for 100 lbs. increase $	Return per bushel of corn cents	Final weight lbs.
Car corn only.	0.816	3.38	87.2	193
Car corn and 10 % meat meal for 90 days. Car corn and 7 % meat meal for 30 days. Car corn and 5 % meat meal for 60 days.	1.022	3.74	85.1	214
Car corn; meat meal in self-feeder. . . .	1.034	3.84	85.6	214
Shelled corn in self-feeder and meat meal in self-feeder.	1.216	3.83	83.9	249

These results show that the addition of meat meal to the ration re-ulted in an increase in the average daily gain, whilst feeding both corn and nkage (swill) in self-feeders gave still larger gains. At first sight it would ppear that the lot receiving only corn as a supplementary ration was the ost profitable, because of its lower cost of 100 lbs. increase and higher turn per bushel of corn, but this is not so since this lot weighed 56 lbs. er hog less at the end of the period than the fastest gaining lot. It is herefore necessary to include the cost of 49 days of dry-lot feeding sub-quent to the forage test, this being the length of time required to bring is lot to the same weight as the best lot (249 lbs.). The other lots were so finished in the same way with the results shown in table II.

TABLE II. — *Results in finishing the lots with unlimited supplies of shelled corn and meat meal.*

Lots.	Duration of finishing days	Average daily gain during whole period. lbs.	Cost of 100 lbs. increase during both periods. $	Return per bushel of corn cents
. . . . .	49	0.951	3.97	75.4
. . . . .	26	1.064	3.96	79.6
. . . . .	26	1.075	4.00	81.1
. . . . .	—	1.216	3.83	83.9

This table shows a significant rapid increase in the cost of the increa in weight as the hogs grow older. In determining the cost of 100 per ce increase, the ear corn is charged at 49 cents a bushel, shelled corn at 50 cen a bushel and meal at $2.50 per 100 lbs. Lucerne is charged at $10.
per acre per annum and the selling price of pork is reckoned at $6 p 100 lbs.

Probably the forage next in order of importance is Dwarf Ess rape, owing to its high protein content and great value as a catch cro The analyses given in Table III show that rape cut to about one inch fro the ground is only rivalled by lucerne as a protein food.

The alfalfa lot making the most profitable gains consumed abo 8 per cent as much meat meal as corn, but the comparison in Table I of the two lots of 30 lb. pigs fed on rape shows that the most profitab lot during both the forage season and the finishing period was the o receiving ear corn only.

TABLE III. — *Percentage composition of forage crops.*

Forage	Moisture	Dry matter	Composition of dry matter				Ash	Ratio of protei to carbo-hydrate equivalen
			Protein	Nitrogen free extract	Crude fibre	Ether extract or fat		
Rape 18"-20". . . .	89.08	10.92	25.77	34.16	17.02	3.65	19.22	2.31
Alfalfa 18"-2	80.65	19.35	22.29	44.89	20.83	1.45	10.54	3.09
Red clover in bloom.	52.48	47.52	15.94	44.21	27.18	2.54	10.15	4.84
Blue grass (*Poa pratensis*) heading. . .	74.06	25.94	11.06	42.98	31.98	2.85	11.14	7.35

TABLE IV. — *Spring pigs fed on rape* (150 *days*) *and finished on corn and meat meal.*

Supplementary rations.	First period (150 days)				Second period			
	Average daily gain	Cost of 100 lbs. gain	Return for a bushel of corn	Final weight	Duration of period	Average daily gain, entire period	Cost of 100 lbs. gain, entire period	Retu per bush of co enti peri
	lbs.	$	cents	lbs.	days	lbs.	$	cen
Ear corn only	0.934	3.45	88.4	179	64	1.027	3.95	77
Ear corn + 5 per cent meat meal	0.984	3.77	85.3	186	53	1.073	4.10	76

These pigs were fed until approximately 250 lbs. in weight, but so cheaply as the best alfalfa lot. Though the alfalfa excelled the r

s regards cost of increase, it should be remembered that the rape sea-on is 30 days shorter than that of alfalfa and that rape forage is obtain-ble from seed much quicker and requires a less protein supplement. Only he Dwarf Essex variety is desirable; Birdseed rape is almost useless as orage.

Third in importance of the forage crops for fattening pigs in the Corn Belt is red clover. It does not give live-weight increases equal to those roduced by lucerne and rape, but it provides good pasturage for two years, sually at a reasonable cost, and being a leguminous plant it enriches the oil more than rape.

In these experiments two lots of young pigs weighing 40 lbs. each were ed on red clover for 140 days, one lot receiving shelled corn alone and he other shelled corn plus 10 per cent meat meal. The former lot made an verage daily gain of 0.846 lb. at a cost of $3.71 per 100 lbs. gain, while he latter gained 1.132 lbs. daily at a cost of $3.84 per 100 lbs., the returns or a bushel of corn being 84.6 and 90.4 cents respectively. If these lots ad been finished off to a uniform weight the odds would have been still nore in favour of the lot receiving the meat meal. A rise in the price f corn of 10 cents per bushel raises the cost of the increases to 4.37 and $4.38 respectively, because of the small amount of corn onsumed in the meat-meal lot. Thus the best results are obtained from ed clover when some tankage (swill) or other protein supplement is used ith the corn.

Kentucky blue grass (*Poa pratensis*), on account of its early and late asture season and its general distribution, ranks with the first-class forages lready mentioned. As has been shown in Table III it is inferior to alfalfa, ape or red clover in protein content, but this analysis was made on a dry ard sample obtained during the summer months. A typical sample of he more tender spring growth shows the following constituents:

	Per cent.
Moisture	68.74
Dry matter	31.26
In 100 parts of dry matter:	
Protein	30.43
Nitrogen-free extract	41.04
Crude fibre	15.23
Ether extract	4.65
Ash	8.64

In this sample the albuminoid ratio is 1 to 2.19, which is less than that iven for any of the forages thus far discussed. However, it should be ointed out that this tender forage is practically all digestible, so that its omposition cannot be exactly compared with that of other forage. Though ery rich in nitrogenous matter for a time, blue grass should be supple-ented with a high protein feed, as shown by the following results:

Two lots of spring pigs averaging 30 lbs. each in weight were fed fo 190 days on blue-grass pasture, the first lot receiving ear corn only and th second ear corn and 12 per cent meat meal. Lot I made an average dail gain of 0.584 lb. at a cost of $3.80 per 100 lbs., with a return 78.9 cents pe bushel of corn; the final average weight of this group was 141 lbs. Lot I gained 0.905 lb. a day at a cost of $4.30 per 100 lbs. and returned 76.1 cent per bushel of corn. Thus the first lot with low protein diet was distinctl inferior. The animals of the second lot averaged 203 lbs. at the end of 19 days and were finished off to the 250 lbs. standard in 30 days, or 45 day earlier than the animals of Lot I, so that Lot II had an average dail gain for the entire period of 0.995 lb. at a cost of $4.31 per 100 lbs., whil Lot I had a daily increase of 0.827 lb. at a cost of $4.17 per 100 lbs.; th returns per bushel of grain were respectively 75 cents and 73.8 cents. It shoul be remembered that the proportion of meat meal allowed (12 per cen is much higher than usual on blue grass, and that Lot II was ready for th market a month and a half earlier than Lot I. If the quantity of mea meal had been reduced to 10 per cent the results would probably have bee practically equal, and the cost of production as low as, if not lower tha that of Lot I. Further, Lot I consumed 8 parts of meat meal per 100 corn in the finishing period, compared with 6 parts per 100 of Lot I thus giving the former a slight advantage over the latter.

Sweet clover (*Melilotus alba*) is often praised as a forage, but it is no to be preferred when any of the previously mentioned crops are availabl It is not suitable for swine forage during its second year, since it becom too rank and woody.

Winter rye and winter wheat provide good pasturage in the autum and spring, though not so desirable as lucerne and blue grass. They a specially suitable for very early and very late pasturage.

Field peas are not so profitable in the Corn Belt as in Canada, sinc they are against more severe competition. It is the same also with soy beans and cowpeas (*Vigna catjang*), which are very useful to breeders the south but seldom extend north of Lat. 41°.

Winter or hairy vetch (*Vicia villosa*) is sometimes recommended a a good forage crop for pigs, though experiments at the Iowa Station gav very poor results. Two lots of autumn pigs of 150 lbs. weight were used one lot received soaked shelled corn and the other soaked shelled corn an meat meal besides vetch forage. The former gained 0.590 lb. daily at cost of $8.84 per 100 lbs. and returned 1.6 cents per bushel for the corn while the latter gained 0.706 lb. daily at the same cost and returne 1.2 cents per bushel on the corn.

Another forage still less worthy of the praise it has received is sorghum It contains about 8 per cent of protein calculated on the dry matter an 1.38 per cent in the natural state, and has approximately the same albumi noid ratio as corn. It would therefore require additional protein to balanc its deficiency.

In 1912, 29 young pigs averaging 20 lbs. each were fed on sorghum forage with a grain ration of 6 parts of ear corn and 1 part meat mea

This ration should produce an average daily gain of 0.5 to 0.75 lb. when fed alone, but in this experiment the gain was only 0.482 lb. during the 96 days of the experiment. The cost of production was $4.25 per 100 lbs. and the final weight of the pigs 70 lbs. each. Another lot fed on rape and receiving a ration of ear corn and one-tenth meat meal made the same total gain in 80 days and a daily gain of 0.738 lb. at a cost of $2.87 per 100 lbs. This low cost of production should be associated with the age of the animals, which was at the most profitable period. Alfalfa, blue grass and red clover also excel sorghum in economical pork production.

201 – **The Feeding Value of *Melinis minutiflora* and *Andropogon rufus*.** — ATHANASSOF, NICOLAU, in *Revista de Veterinaria e Zootechnia*, Year IV, No 5, pp. 287-293 + 2 figs. + 2 diagrams. Rio de Janeiro, October 1914.

In Brazil, *Melinis minutiflora* and *Andropogon rufus* form the main food of live stock, which take them either as pasturage or as hay. Analyses carried out at the Agricultural Institute of Campinas show the percentage composition as given in the accompanying table.

Percentage composition of the hay under investigation.

	Moisture	Protein	Fat	N-free extract	Fibre	Ash	Potash	Lime	Phosphoric acid	Silica
Melinis hay (red.)	21.20	8.42	1.75	36.22	24.29	8.22	2.387	0.421	0.241	—
Melinis hay (white)	16.54	6.33	1.67	38.97	27.58	8.91	2.373	0.552	0.259	—
Average . . .	18.82	7.37	1.71	37.59	25.93	8.56	2.380	0.484	0.250	4.7
Hay of *Andropogon* before flowering	18.95	5.78	1.01	33.82	30.92	9.52	1.697	0.442	0.180	—
Hay of *Andropogon* after flowering	10.12	4.66	1.41	40.42	35.67	7.71	0.922	0.582	0.585	—
Average . . .	14.53	5.22	1.21	37.12	33.29	8.61	1.309	0.512	0.382	5.9

Although the analyses are not sufficiently numerous to make a complete study, they show that *Melinis* hay, having an albuminoid ratio of 1 : 7, is more suitable for milk production, and that *Andropogon* hay having a ratio of 1 : 10.5 to 1: 15 is specially suitable for fattening and working animals.

With a view to obtaining precise data on this subject, experiments were carried out at the Federal Live-Stock Station at Pinheiro between August 1st and October 19th 1913. Twelve milch cows were selected of almost equal ages and nearly all in the first period of lactation, yielding almost equal quantities of milk of similar composition, so that any variations occurring

could be attributed to changes in the diet. They were divided into three groups of average weights 990, 935 and 715 lbs. respectively. They were milked at 6 a. m. and 4 p. m. and the milk was weighed and its fat content tested by the Gerber method each day. The experiment covered four periods of 20 days each, and the rations were as follows :

A. 53 lbs. of mixed forage and bran containing 6 ½ lbs. of *Melinis* hay. Ration containing 55 per cent of water and 23.65 lbs. of dry matter.

B. 53 lbs. of the same mixture, but containing 6 ½ lbs. of *Andropogon* hay in place of *Melinis* hay. Ration containing 55.5 per cent of water and 23.49 lbs. of dry matter.

C. 52.8 lbs. of the mixture as in A, with 22 lbs. of maize forage. Ration containing 63.3 per cent of water and 27.43 lbs. of dry matter.

Ration A was fed during the first and fourth periods : ration B during the second, and ration C during the third. The writer draws the following conclusions :

1. Throughout the first period (ration A), the yield of milk remained constant and the live-weight increased slightly (0.6 lb. per cow per day).

2. During the second period (ration B), the yield of milk diminished by 1.067 lb., and the live-weight increased by 2.552 lbs. per cow per day.

3. The addition of maize forage during the third period had the effect of increasing the yield of milk slightly.

4. The return to ration A in the fourth period increased the yield of milk and its fat content at the expense of the live-weight.

Thus the hay of *Melinis* has a favourable influence on the milk yield and maintains the live-weight, whilst the hay of *Andropogon rufus* is of inferior value for milk production but more valuable for meat production. It is therefore recommended for fattening animals and beasts of burden or for cows in poor condition.

202 – **The Histology of Flax Fruit.** — WINTON, KATE BARBER, in *The Botanical Gazette*, Vol. LVIII, No. 5, pp. 445-448 + 4 figs. Chicago, November 1914.

Since the chaff from the threshing of flax-seeds, consisting of broken pods and stems with varying amounts of immature and broken seeds, has of late come into the market under the name of " flax bran " as cattle food, some means for its microscopic identification is necessary.

Recent studies on the histology of the pericarp of flax fruit do not agree with the observations of Collin and Perrot, who found crystals in the epicarp layer. These investigations show that the tissues of chief value in the identification of flax fruit in ground products, such as mixed cattle feed, are the elongated, thick-walled cells of the hypoderm with projections, the accompanying cells each containing a single crystal, and the transparent dissepiments of the capsule with elongated cells, those of the two epidermal layers often crossing at an angle.

203 – **The Utilisation of Cereal Offals and Other Products for Feeding Purposes.** — — *The Journal of the Board of Agriculture*, Vol. XXI, No. 7, pp. 603-610. London, October 1914.

The feeding-stuffs dealt with in this article are : wheat bran ; sharps and middlings ; dried grains ; dried yeast ; gluten meal and gluten feed ;

soya bean cake and meal; coconut cake; palm-nut cake; fish meal. The formation of rations with these foods is shown in the following tables. In each case Ration I represents a common daily diet for a full-grown animal, and the alternative rations show how by using other feeding-stuffs the diet may be cheapened. The prices of roots, hay and straw have been taken as 10s, 60s and 30s per ton respectively, the prices of other feeding-stuffs being those ruling in London in September.

Farm Horses.

Ration I.	s d	*Ration II.*	s d
18 lb. Hay 14 » Oats	1–8	18 lb. Hay 6 » Dried Grains 2 » Sharps 4 » Bran 2 » Maize	1–2

Light-legged Horses.

Ration I.	s d	*Ration II.*	s d
10 lb. Hay 16 » Oats	1–7	10 lb. Hay 6 » Oats 2 » Beans 5 » Dried Grains 2 » Bran	1–3

Fattening Bullocks (2 ½-3 years old).

Ration I.	s d	*Ration II.*	s d
70 lb. Swedes or Mangolds 16 » Oat Straw 2 » Undecorticated Cotton Cake 3 » Maize 2 » Linseed Cake	1–0	70 lb. Swedes or Mangolds 16 » Oat Straw 2 » Undecorticated Cotton Cake 3 » Dried Grains 3 » Bran	0–10½

Ration III.	s d	*Ration IV.*	s d
90 lb. Swedes 12 » Oat Straw 4 » Undecorticated Cotton Cake 4 » Bran	0–10½	35 lb Swedes or Mangolds 7 » Hay 10 » Oat Straw 2 » Undecorticated Cotton Cake 2 » Soya Bean Cake 2 » Sharps 2 » Dried Grains	0–10½

Cows.

Ration I.	s d	*Ration II.*	s d
42 lb. Swedes or Mangolds 5 » Hay 14 » Oat Straw 4 » Crushed Oats 4 » Decorticated Cotton Cake	1–2	42 lb. Swedes or Mangolds 5 » Hay 14 » Straw 4 » Coconut Cake or Palm-Nut Cake 3 » Dried Grains 2 » Bran	0–11

Ration III.	s d
28 lb. Swedes or Mangolds 14 » Hay 7 » Straw 2 » Coconut Cake 2 » Undecorticated Cotton Cake 3 » Dried Grains 3 » Bran	1–2

The following are suggested as suitable rations for sheep, to be fed along with grass, or roots and hay, at times when concentrated foods are necessary.

Breeding Ewes	*Ration I.*	From ½ to 1 lb. per head per day, of oats, bran and decorticated cotton cake mixed in the ratio 2 : 2 : 1 respectively. Cost; $^4/_5 d$ per lb.
	Ration II.	The same weight of a mixture of equal parts of soya bean cake, bran and dried grains. Cost : $^3/_5 d$ per lb.
Fattening Sheep.	*Ration I.*	From ¼ to 1 lb. per head per day of a mixture of equal parts of maize and decorticated cotton cake. Cost: 1 *d* per lb. (nearly).
	Ration II.	The same weight of a mixture of dried grains and soya bean cake. Cost: $^3/_4 d$ per lb. (nearly).

204 – **The Feeding Value of Refuse Brewers' Yeast** (1) **: Hungarian Experiments.** — SCHANDL, JÓZSEF, in *Köztelek*, Year 24, No. 76, pp. 2658-2659. Budapest, November 28, 1914.

Pure brewers' yeast consists of *Saccharomyces cerevisiae*, but after a certain time it becomes infected with other micro-organisms which render it useless for brewing purposes. The degenerated product thus becomes available for other uses. During the winter of 1914, the writer received the waste yeast from the Czell brewery at Monostor with a view to determining its feeding value. This yeast was comparatively rich in protein and had the following chemical composition :

	Percentage
Moisture	87.67
Dry matter	12.33
Composition of dry matter:	
Protein	6.69
Fats	0.14
Nitrogen-free extract	4.49
Ash	1.01

The product cannot be used for feeding purposes as it comes from the brewery, owing to the danger of abnormal or excessive fermentation in the stomach of the animal, and to its bitter taste and strong smell. After subjecting it to a simple cooking process it was readily accepted by sheep and pigs, but cows and foals refused to touch it until after 24 hours, when the disagreeable taste and smell had disappeared. By observing this precaution, several series of experiments were successfully carried out with all these animals.

The first series of experiments to determine its coefficient of digestibility were carried out with two rams of the Racka breed. During the first period they received 1 ½ lbs. of chopped clover and, during the second period, the same rations with ½ lb. of yeast. Each period lasted 8 days,

(1) See also: F. HAYDUCK, « The Development of the Dried Yeast Industry in Germany », *B.* May 1913, pp. 692-696; and *B.* Jan. 1913, No. 47; *B.* Dec. 1913, No. 1357. (*Ed.*).

uring which no disturbance of the health of the animals was noticed. ccording to the tables showing the digestibility of the rations, the animals similated the constituents of the yeast as follows: protein 97-86 per cent, trogen-free extract 82-86 per cent, and dry matter 89-54 per cent. Thus, ewers' yeast, owing to its high coefficient of digestibility, belongs to the ore easily digested foodstuffs. Its starch value, according to Kellner's gures, is 9.871 per cent of the yeast.

The following experiments were carried out with five cows of the berinntal breed, containing some Brown Swiss blood, of approximately e same age. To determine the specific effect of the yeast on the produc-on of milk, the experiment was divided into three periods of 30 days each, uring which the animals received the following additions to their ndamental rations: in the first and third periods 4.4 lbs. of sunflower ke and in the second period 2.2 lbs. of sunflower cake and 11 lbs. of east. The yields of milk and butter-fat are given in the following table:

	Weight of milk, in lbs.					Butter fat, in lbs.				
w's no.	1	2	3	4	5	1	2	3	4	5
t and 3rd periods (averages)	459.8	216.4	690.9	369.3	616.0	8.4	9.1	7.4	8.6	8.7
d period	457.0	187.2	675.0	399.7	623.9	9.0	9.3	7.4	8.6	8.7
crease (+) or decrease (—)	—2.8	—29.2	—15.9	+30.4	+7.9	+0.6	+0.2	—	—	—

These show that yeast exerts no specific influence on the yield of milk.

A third series of experiments was made on horses and pigs. Seven rses (from 1 to 2 years old) were fed for 34 days on 2.2 lbs. of yeast per ad per day mixed with chopped straw, in addition to their fundamental tion. The pigs received 10 lbs. of yeast per 1000 lbs. live-weight, mixed th barley meal.

The results of these experiments are summarised as follows:

1. Waste yeast is consumed readily by all live stock 24 hours after has been cooked. The following quantities per 1000 lbs. live-weight ay safely be given: horses 4 lbs., cows 10 lbs., sheep 5 lbs, pigs 10 lbs.
2. The starch equivalent is equal to 80 per cent of the dry matter.
3. Its food value to dairy cows is in proportion to its starch equi-ent and its percentage of protein.

CATTLE

– Influence of Grazing and of Dry Stall-Feeding on Milk. — BRUNOVSKY, K., in *Molotchnoe Khosiaistvo i Skolovodstvo* (*Dairying and Stock Breeding*), Year 13, No. 38, pp. 791-794. Moscow, September 1914.

The writer fed a cow at the Agricultural School of Petrograd, for enty days as follows: first four days the whole time in a meadow; next r days half the day in the stable where she was fed 11 lbs. of meadow y; third four days in the stable, 22 lbs. of hay being fed; fourth four days e the second; fifth like the first. The quantity of milk, and its fat ntent, acidity, etc., were determined three times a day.

It was found that while grazing, the cow yielded 20.3 lbs. of mi and when stall fed only 16.3 lbs. The fat content increased when the co was transferred from the meadow to the stall from 3.7 to 4.05.

POULTRY

206 – **Some Factors Affecting the Weight, Composition and Hatchability of H Eggs.** — ATWOOD, HORACE, in *West Virginia University Agricultural Experim Station, Bulletin* No. 145 (May 1914), Summarised in *Circular No.* 9, pp. 1-4. M gantown, W. Va., June 1914.

It has been found that there is a very appreciable difference in t average weight of eggs produced at different seasons of the year; the weig reaches a maximum in the early spring when the fowls are heaviest a laying most freely. With one lot of fowls which received green food addition to the grain ration the average weight varied from 12.72 l per hundred in February to 11.07 lbs. in June. In a pen of fowls receivi no green food the weight varied from 13.33 lbs. in February to 11. lbs. in July.

On August, 1, 1911, an experiment was begun with six lots of fo to determine the effect of liberal versus scanty feeding, upon the numb and weight of eggs produced and their hatchability. This experime was continued for two years with the same fowls. The three pens of fo fed liberally laid 8062 eggs and those fed scantily laid 5144. This sho the importance of liberal feeding in the economical production of eg The two pens of pullets fed liberally averaged 138.7 eggs each, while t pen of yearling hens fed liberally laid only 125.6 eggs each, showing that t greatest egg production is to be expected during the pullet year. Duri the month of March the eggs from the pens fed liberally averaged 6 grams each, while those from the other pens averaged 57.6 grams, or a crease of about 4 ½ per cent. It is therefore concluded that scanty fe ing reduces slightly the size of the eggs.

Considering the effect of feeding on the hatchability of the eggs, is found that when fowls are fed too scantily the fertility of the eggs low, but those which are fertile seem to hatch practically as well as t fertile eggs laid by the fowls fed heavily. When fowls have been lay heavily for a considerable length of time, their eggs are less fertile and not hatch as well as eggs laid by fowls which are just reaching or ha reached their maximum egg production for the season. There seems be no great difference in the vigour of the chicks from the two lots of fo In general, the chicks hatched from eggs laid by the fowls fed libera average somewhat heavier than those hatched from the other eggs. Ex riments conducted at this Station and at the New York State Coll of Agriculture at Cornell University, have shown that chickens hatched fr heavy eggs are heavier and more thrifty than chickens hatched from e lighter in weight. It is therefore important to select heavy eggs for incu tion purposes.

Analyses indicate that during the spring, when hens are laying well when the eggs are heavier than at any other time of the year, the dry mat of the yolk constitutes a greater percentage of the total weight of the than in the fall, when the fowls are laying less liberally. This may be

additional reason why early-hatched chickens are more vigorous than those hatched later, for it is reasonable to suppose that the larger the yolk the more perfectly nourished will be the embryo.

The next question is whether the amount of phosphorus in a ration for laying hens affects either the number of eggs laid or their size or composition. If a lack of phosphorus causes a diminution in the phosphorus content of the eggs produced, this possibly may be one reason why late-hatched chicks are less thrifty than those hatched earlier in the season. It is conceivable that a fowl during the normal resting period, while moulting and before beginning to lay, stores up a supply of phosphorus in the body which is drawn upon to supplement the amount assimilated from the ration, thus providing the early-laid eggs with a liberal supply of the necessary phosphorised materials in the yolk substances, and that later in the season, the available stored-up body phosphorus having been used up, the eggs may be less abundantly supplied with these essential compounds, with the effect that the resulting chickens are less perfectly nourished and consequently weaker. In the absence of a sufficient supply of phosphorus, even though the composition of the phosphorised yolk substances remains unchanged, the relative amount of yolk may be diminished, thus weakening the chick. To study this point a feeding experiment was carried out and many eggs analysed. The results show that when laying hens are fed a ration especially compounded so as to be poor in phosphorus, the relative size of the yolks of the eggs is reduced ; the yolks and shells contain a sightly less percentage of phosphorus, and the total number of eggs laid is materially diminished. During the course of a year, and under normal conditions, there is phosphorus equivalent to about 37 grams of phosphoric acid present in the eggs laid by a hen. The ordinary grain ration fed to laying hens contains several times as much phosphorus as is found in the eggs produced.

207 – **The Selection of Good Layers.** — POTTS, CUTHBERT (Hawkesbury Agricultural College) : Average and Frequency Curves (presented to the Sixth Annual Conference of Poultry Farmers, Hawkesbury Agricultural College, N. S. W., 20 June 1914), in *Department of Agriculture, New South Wales, Farmers' Bulletin* No. 93, pp. 12-13. Sydney, September 1914.

The writer draws conclusions from the results of 10 years' egg-laying competitions in New South Wales with the three breeds White Leghorn, Black Orpington and Silver Wyandotte. The analysis of the results was made with the assistance of curves drawn from the tabulated results of the competitions. It was shown that there appeared to be two distinct families in each breed throwing true as regards egg-laying capacity, one of these (called the " low-bred ") having a lower egg-laying capacity than the other ; while each family has a definite average egg-laying capacity, individual pullets will lay above or below that average.

From an examination of the three curves it was shown that :

1) The high and low-bred families are about equally balanced in the case of the White Leghorn ; hence there should be scope for consider-

able improvement by careful selection. Further, the Leghorns exhibit indications of having a higher egg-laying capacity than any other breed.

2) The low-bred family predominates in the case of the Black Orpingtons ; hence, improvement by seleczion has much bad material to dispose of. The possibilities of the high-bred family, however, show that they are worthy of more attention than they have so far received.

3) In the case of the Silver Wyandotte, the high-bred family predominates. The curve indicates that it could not attain the egg-laying capacity of either of the breeds mentioned above ; still, with the high-bred family predominating, it should be a matter of ease to establish a flock having a good average capacity for egg-laying.

With regard to breeding, it was shown that if a pullet of exceptionally high egg-laying capacity is chosen, it is more than probable that she belongs to the high-bred family, while it is doubtful whether a pullet of average capacity belongs to the low-or high-bred family, and in all probability she is a hybrid between the two.

To establish the high-bred family, it is essential to choose the breeders from the family of higher egg-laying capacity. It has been seen that the exceptionally good layer probably belongs to this family. However, it would appear to be unwise to breed from her, since she is an exception, and her progeny, in order to maintain the average of the family, would be low layers by way of compensation. The true sisters and brothers of the exceptional pullet would be the best birds to breed from, and the hens should not be much above the average of the family.

208 – **Peacock-Guineafowl Hybrids.** — BRENTANA, D. (Live Stock Institute of the Royal University of Parma), in *Il Moderno Zooiatro*, Series V, Year III, No. 11, pp. 1001-1009 + 2 figs. Bologna, November 30, 1914.

The writer enumerates several instances of hybridisation between different species of the same genera in the family Phasianidae (including the three groups : turkeys, guineafowls, fowls) and observes that between species not very nearly related such cases are rare in the wild state, and that the males of such hybrids tend to show female characters in the plumage ; on the contrary, the hybrids between closely related species do not show this reversion and the colours of the plumage blend in a pleasing manner, giving rise to intermediate forms or varieties of the parental forms.

It is possible to have by chance hybrids of species belonging to different genera of *Phasianidae*. The most remarkable hybrids of this group obtained are as follows :

Tragopan temmincki × *Catreus wallichi*
Acomus erythrophthalmus × *Gennaeus muthura*
Lophura diardi × *Gennaeus lineatus*
Gennaeus horsfieldi × *Phasianus versicolar*
Catreus wallichi × *Phasianus colchicus*
Gennaeus muthura × *Phasianus colchicus*
Phasianus colchicus × *Gallus domesticus*
Phasianus colchicus × *Chrysolophus pictus*

Phasianus reevesi × *Chrysolophus pictus*
Phasianus colchicus × *Gennaeus nycthemerus*
Chrysolophus pictus × *Gallus domesticus*
Pavo cristatus × *Numida meleagris*
Gallus domesticus × *Numida meleagris.*

The two hybrids (only one of which was living) observed by the writer were the result of the spontaneous hybridisation between two grey guineafowl hens and a peacock. Previous records of this hybrid were very few. The hybrids in question resemble the peacock more in their general slender form, especially in the head and neck ; at the same time there is a notieable absence of all the characteristic appendages of the head; the train is much reduced. The plumage exhibits striping, which is to be considered as the primitive type; it is of a dark fawn with black stripes in the lower part of the neck, becoming paler fawn with black specks in the region of the thorax, abdomen and flanks. The tail has 16 feathers and is shorter than the wings as in the guineafowl.

209 – **The Temperature of the Honey Bee Cluster in Winter.** — PHILLIPS, E. F. (In charge of Bee Culture Investigations), and DEMUTH, GEORGE S. (Apicultural Assistant), in *Bulletin of the U. S. Department of Agriculture*, No. 93, pp. 16 + 2 diagrams. Washington, 1914. BEES

This is a preliminary report giving some of the results obtained in the first season's work on the behaviour of bees during the winter season and in particular the results of studies on the heat production of swarming bees in relation to external temperature. Because of the errors in other work on the subject due to the use of mercury thermometers, electrical thermometers were used in these experiments. By this means it has been possible to follow closely the activities of each cluster without opening the hives and even without going near them. One colony was contained in a 10-frame Langstroth hive fitted with 19 electrical thermometers : 12 among the combs, 4 in the corners of the hive and 3 on the bottom board. Other colonies were wintered in the constant temperature room in special 6-frame hives. The maximum temperature of this room was 45° F. Colonies were also kept on the roof of the laboratory. The wires of all the thermometers were conducted to a separate room so as to avoid disturbance of the temperatures. After becoming familiar with the normal temperature and the temperatures incident to various activities, it is possible to determine the shape, location and various activities of the cluster by a study of the temperature of different points within the hive, and to form an opinion as to the welfare of the colony.

The writers conclude that : generally after a cold period when the external temperature begins to rise, the temperature of the swarm falls slowly and tends to assume equilibrium with the external temperature. The production of heat is limited or even checked and only increases when the exterior temperature falls again or rises sufficiently high to provoke a much greater activity, as in the flight. When the cluster temperature is above about 69° F. it is less constant than when it is below this tempera-

ture, indicating that at low temperatures above this point the bees move about to some extent, while between 57° and 69° they are quiet, unless flight is desirable owing to a long confinement.

When a colony is without brood, if the bees do not fly and are not disturbed and if the temperature does not rise too high, the bees generate practically no heat until the coolest point among them reaches a temperature of about 57° F. At higher temperatures a compact cluster is not formed, but the bees are widely distributed over the combs. At the lower critical temperature, which is for the present stated as 57° F., the bees begin to form a compact cluster, and if the temperature of the air surrounding them continues to drop they begin to generate heat within the cluster, often reaching temperatures considerably higher than those at which they were formerly quiet and satisfied. It is evident, therefore, that the temperature within the cluster is far from being uniform in winter, as has been, in a sense, assumed among practical beekeepers. At the temperature at which other insects become less active (begin hibernation) the honey bee becomes more active and generates heat, in some cases until the temperature within the cluster is as high as that of the brood nest in summer. Thus, when the temperature of a colony of undisturbed broodless bees is above 57° F. and below about 69° F. the bees are quiet and their temperature drifts with the outer temperature; at lower temperatures they form a compact cluster, and the temperature within it is raised by heat generated by the bees.

With a brood colony, on the other hand, rearing during the winter causes such a marked increase in temperature as to constitute a condition most disastrous to the life of the colony.

During the active summer season the length of life of worker bees is in a sense determined by the work done by them and in inverse proportion. The writers believe that they have evidence to prove that this applies to the winter also. In order to obtain strong, vigorous bees in the spring, it follows that the work to be done by the bees in the winter should be reduced to a minimum, that is to say they should have the necessity for the production of heat reduced to a minimum. If brood is reared, the colony is not fully recompensed for the reduction of vitality by the increased numbers in the colony.

The accumulation of feces in the intestine acts as an irritant, causing the bees to become more active and consequently to maintain a higher temperature with greater consumption of food. This is due to the honeydew, which forms a poor substitute for honey. It contains the same sugars but also a considerable amount of dextrin which is difficult of digestion. Keeping the bees in a cellar protected from low outside temperatures prevented the normal ejection of the feces and produced a condition more serious than that of extreme cold weather in colonies freely exposed.

The highest temperatures of the swarm are in the centre and gradually diminish towards the exterior layers. The outer shell constitutes an ideal

insulator for the conservation of heat, since the bees arranged so close together form small dead air spaces in their interlacing hairs, especially those of the thorax, and afford still more insulation with their bodies. The heat produced by the bees comes naturally from the oxidation of the food consumed, and it is produced by muscular activity. In cold weather the bees in the centre of the shell of insulating bees have been observed fanning vigorously and executing other movements such as shaking and rapid respiration. These observations are supported by the humming noise frequently heard from a swarm during cold weather.

210 - ***Henneguya* Cysts under the Scales of Perch.** — BROFELDT, PEKKA, in *Zeitschrift für Fischerei*, Vol. 14, Part 5, pp. 354-356 + 3 figs. Berlin, 1914. FISH BREEDING

While examining some hundreds of perch 4 to 6 in. long from the Müggelsee near Berlin, the writer found one which had small scattered white spots on its skin ; these on closer investigation proved to be small cysts with typical *Henneguya* spores beneath the scales. A careful examination of the rest of the perch showed that about 25 per cent were attacked. A later investigation of perch from the same lake gave similar results.

The *Henneguya* cysts lie in the scale pockets and are to be found on every part of the body which is covered by scales. They are flattened, circular discs with a diameter of from 0.600 to 0.678 mm. Usually there is only one cyst beneath each scale (only in two cases were two found side by side) and a single fish seldom harbours more than 10. In the case of fish caught in January, the cyst-wall was fairly strong and its contents consisted of few well-developed spores. The cyst-walls of perch examined on April 10 were so thin that they burst at the slightest touch and allowed the spores to escape. No cysts could be seen in the case of fish caught on April 25, as they had all burst.

The spores, when fully developed, were on an average 0.032 mm. in length and 0.008 mm. in breadth, the length of their processes being 0.039 mm.

Whether this *Henneguya* is identical with the species occurring in the gills, or is a special kind, is difficult to decide. On comparing it with *Henneguya psorospermica*, which lives in the gills, it is seen that the spores are of the same shape and size, but those of the latter are ripe in January and the spores of the former in April.

211 - **Purification of Sewage by means of Fish Ponds.** — RÉPÁSSY, MIKLÓS in *Vizügyi Közlemények*, Year IV, No. 6, pp. 185-196. Budapest, November-December 1914.

A great deal of attention has recently been paid in Germany to the purification of sewage by the agency of fish ponds, which means neither more nor less than the manuring of the ponds. A study of the question was initiated by Dr. B. HOFER (1) lecturer at the Veterinary College of Munich. The fact that the fish production of ponds can be materially increased by the application of ordinary manures, such as farmyard dung, night soil,

(1) B. HOFER. Teichdüngungsversuche. — *Allgemeine Fischerei-Zeitung*, Year XXXIX, No. 6, p. 139. Munich, 1914. (*Ed.*).

or any other organic putrescible matters, gave him the idea of leading sewage into fish ponds with the view of increasing the fish production in the ponds and at the same time purifying the sewage. The method has not yet been practically applied, but the results of several experiments so far carried out give very encouraging results.

Hofer starts with the theory that the slower the current the greater is the increase of the acquatic population and accordingly the more intense become the biological procesess of auto-purification; consequently stiller waters are for the reception of sewage preferable to more rapid streams. But as the former do not possess the same breaking-up action as the more quickly moving streams, it is desirable to effect a preliminary purification of the liquid issuing from the draims, so that is may be equally distributed in the receiving water. In this fashion the still running water will receive a constant supply of sewage, which, purified by the action of the vegetable and animal population, will be free from any deleterions action.

The writer describes the most important trials so far made, which were begun at Strasburg in 1911 at the suggestion of Hofer ; they are still being continued on four fishponds occupying altogether an area of over 7 acres with a water surface of nearly 5 acres. The sewage conducted into the ponds is in quantity equivalent to the amount derived from 6000 persons. Before being carried into the ponds it is subjected to two preliminary purifications firstly by means of a sifting wheel (Geiger's system) and secondly to 2 or 3 dilutions in reservoirs. The tanks are oblong in shape being 130 to 160 feet wide and about 300 to 500 feet long. Near the edge of the tank the depth of the water is about one foot and in the middle 20 inches, and of double that depth towards the exit. A less depth is, however, recommended in order that light and the warmth of the sun may act more readily on the transformation of the matter contained in the liquid. The sewage is conducted into the tanks by pipes of horseshoe shape. It remains there for 20 or 30 days.

Before the sewage is run in, each tank should be replenished with pure water for 2 or 3 weeks in order that the acquatic population may better develop. For gauging the progress of clarification, it is desirable to make a daily observation of the oxygen content of the water. The water issuing from the tank is without colour or smell, just like drinking water in appearance and can without risk be led into any kind of stream.

As to the yield of fish, the results have exceeded all anticipation. In 1913 the weight was 455 lbs. per acre. It may be added that the flavour of the fish was in no way altered.

Having before him information as to the results of Hofer's system, the writer considers the possibility of its application to Hungary. There are some obstacles in the way of applying the system : 1) it demands in the purposes of preliminary purification and dilution of drain water a quantity of fresh water in excess of what is available in the Hungarian fish-breeding establishments ; 2) the installation of the system in the ponds requires great care ; 3) the even distribution of the sewage in the water is almost impossible in the case of large ponds.

None of the trial ponds at Strasburg has an area even of one hectare (2 ½ acres); it would hardly be possible to carry into effect the purification of sewage over the areas of 100 to 200 acres which are usual in Hungary, while subdivision of the tanks would add considerably to the cost of installation.

The writer holds that so far as can be jugded from the results of experiments hitherto tried it would be premature to announce a system of purification of sewage by the agency of fish ponds. These fish ponds cannot entirely accomplish the purpose in view, seeing that their action is not continuous (during the winter the tanks have to be drained dry at the time when the fish are removed) ; but it may be found feasible to make periodical use of them to a limited extent.

FARM ENGINEERING.

212 – **Machine for Sorting out Frosted Oranges and Lemons.** — McKinstry, Shelby, in *Scientific American*, Vol. CXI, No. 25, p. 512. New York, December 19, 1914.

AGRICULTURAL MACHINERY AND IMPLEMENTS

Oranges and lemons when they are frosted or frozen do not show, on their outside, any trace of injury, and the only way of determining the damage was by cutting them in two and looking at the juice globules. But the growers cannot afford to cut every fruit, and consequently enormous quantities of good fruit used to be thrown away for the want of a sure way of sorting out the frozen fruit.

Fortunately there is now a very simple separator, the invention of Frank Chase, a Calfornia orange grower, with which the injured fruit may readily be sorted out from the sound specimens. The device consists of a long trough containing water. At one end is a feeder board on which the fruit is dumped and whence it is carried by a cleated conveyor to the edge of the trough from which it falls into the water in an orderly way and not in heaps.

Frosted oranges and lemons are lighter than sound fruit and the greater the injury the lighter they become. Thus when they fall into the water, the sound fruit sinks to the bottom while the badly frosted fruit floats, and the slightly injured occupies intermediate positions. The water is kept moving toward a chute where the fruit is caught by screens adjusted to various depths in the trough. With this water separator five grades of fruit may be separated at one operation. It came into use in California in the spring of 1913 and it is estimated to have saved that year many thousand dolla'sr, worth of fruit.

213 – **Description of the Milking Machines tried at the Alnarp Institute (Official Swedish Experiment Station for Agricultural Machines and Implements).** — *Communication by* F. L. Rosengren, *transmitted to the International Institute of Agriculture by its correspondent for Sweden,* Prof. J. Dannefelt.

As it becomes always more difficult to get competent milkers, the question of using milking machines gains daily in importance. Many inventors have sought a practical solution of the problem of mechanical milking

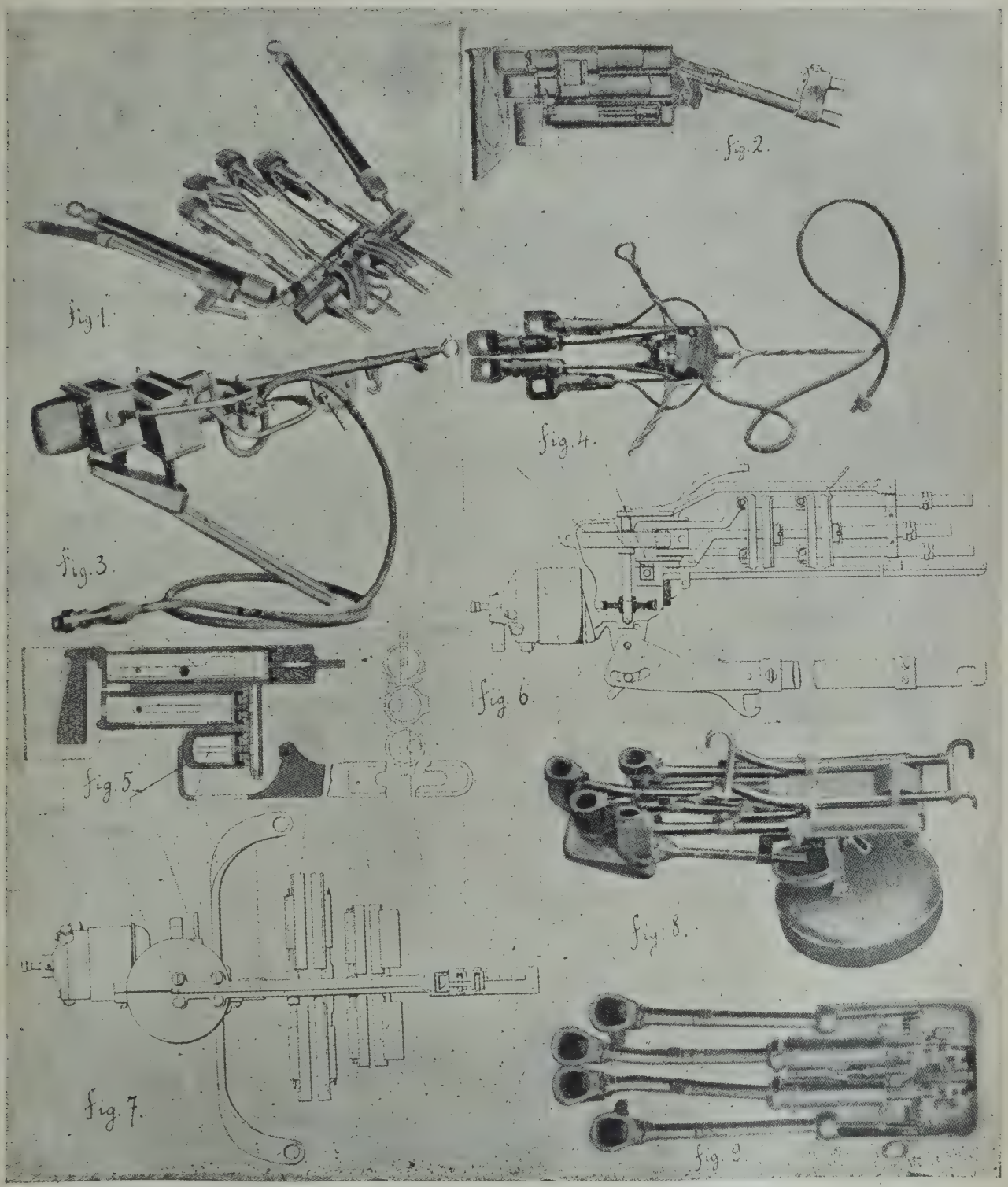
and a number of machines have ben placed on the market. Recognizing the great importance of becoming acquainted with the practical utility of milking machines, the Alnarp Institute began milking trials in 1909; these have been continued almost yearly during the months October to May. For the trial of each machine, 24 Dutch cows were generally used. of which one-third were heavy milkers, one-third average and one-third light milkers. At first each machine was tried for nine weeks. The cows were divided into two groups. The first three weeks one group was machine-milked and the other hand-milked, the next three weeks the hand-milked cows were milked by the machine and *vice versa*, and during the last three weeks both groups were machine-milked. By thus alternating the two systems of milking it was hoped to determine the influence of machine milking on the yield in comparison of hand-milking. But as cows require some days to get accustomed to a change in the methods of milking, perturbations in the milk yields were produced; moreover, the number of machines entered for the trials increased and the time available for each diminished in consequence. For these reasons the trial of each machine was eventually carried out during three weeks only and preceded and followed by a period of hand-milking.

During the trials, the machines were worked by men sent by the makers of each machine and as many machine were handled as one person could manage at the same time according to the statement of the makers. Stripping was entrusted to a capable milk-maid, employed by the Institute. Observations were made on the time required for milking, on the amount of milk obtained, on the amount remaining in the udder, on the purity of the milk and on the consumption of power.

A. — *Machines working by pressure*, tested as specified above:

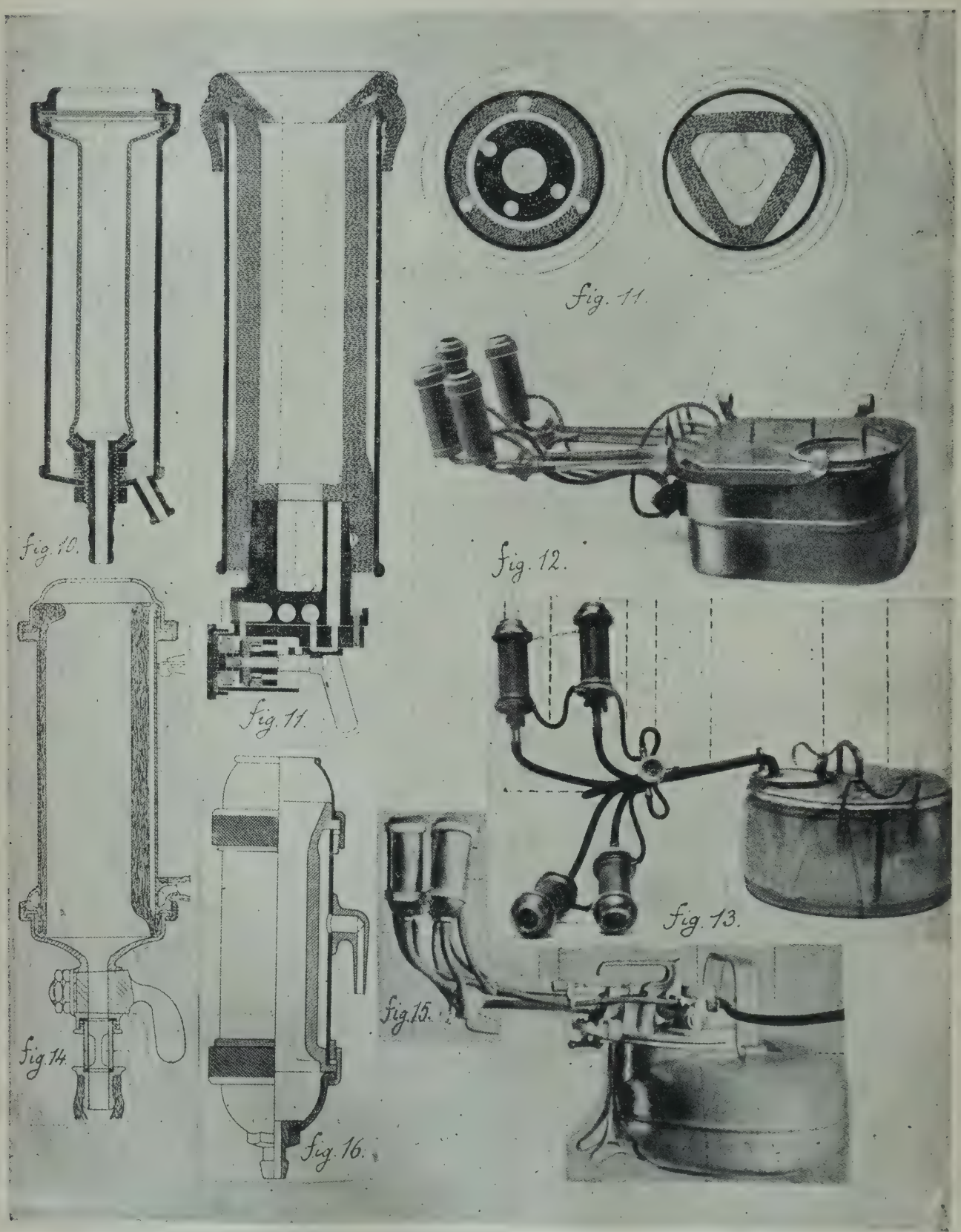
1. ALFA *milking machine* (figs. 1 and 2, patented by LJUNGSTRÖM, manufactured by the MJÖLKNINGSMASKIN AKTIEBOLAGET, Stockholm), with four milkers, each of which is fixed to an arm borne by a cross piece. By an ingenious arrangement the arms are very mobile and can be fixed in any position to fit the teats. Each milker is composed of three cylinders provided with pistons and a conical celluloid envelope. The pistons are pressed one after the other, beginning from the top, against the teat placed in the celluloid envelope or teat-cup, by the pressure of water supplied by a pump situated above the cow. During the back stroke of the pump piston, the pistons of the milkers are brought back to their original position by suction.

2. DALEN *milking machine* (fig. 3; later called the "ALFA" when the one bearing this name was no longer made; manufactured by the MJÖLKNINGSMASKIN AKTIEBOLAGET, Stockholm). It is provided with two milkers, each for two teats. The milkers are attached to two steel tubes, in such a way that they can be shifted to fit the teats. Each milker consists of two rubber plates, the teat compressors, placed in a box. One of them is fixed to one of the long sides of the box; the other is worked by



Explanation.

Fig. 1. – ALFA.
Fig. 2. – ALFA, section.
Fig. 3. – DALEN.
Fig. 4. – OMEGA.
Fig. 5. – OMEGA, section.
Fig. 6. - LOQUIST, vertical section.
Fig. 7. LOQUIST, plan.
Fig. 8. – MANUS, general view.
Fig. 9. – MANUS, from above, without casing.



Explanation.

Fig. 10. – MAX, teat-cup.
Fig. 11. – OMEGA, teat-cup and pulsator; vertical (left) and horizontal (right) sections.
Fig. 12. OMEGA, general view.
Fig. 13. COMOR, general view.
Fig. 14. – COMOR, vertical section of teat-cup.
Fig. 15. – MANUS III, general view.
Fig. 16. – MANUS III, vertical section of teat-cup.

two pistons driven by compressed air. The upper piston first causes the upper edge of the rubber plate to advance and compress the upper part of the teat. Then the lower piston comes forward and presses the milk out of the teat. At this stage the pressure of the air, which is regulated by a pulsator, ceases automatically, and two springs in each box cause the rubbers to return to their original positions.

3. LINDSTRÖM *milking machine* (figs. 4 and 5, called later the AMO milking machine or the OMEGA pressure milking machine. Made by IVAR LINDSTRÖM, Vibynäs, Nykvarn). It is fitted with four milkers fixed to arms which issue from the pulsator box. Each arm may be moved lengthways and turned in every direction. Each milker consists of three small cylinders situated one above the other and containing pistons worked by compressed air. The two upper pistons compress the teat, placed in a celluloid teat cup, from the top downwards. The lowest piston presses against a rest on the frame and tilts the milker in such a way as to pull the teat downwards during compression, simulating the motion of hand-milking. When the pistons have compressed the teats a pulsator interrupts the air pressure and a spiral spring brings the pistons back to their original position.

4. LOQUIST *milking machine* (figs. 6 and 7, constructed by AUG. STALBERG, Eskilstuna). It has four milkers, each of which consists of two plates driven by an electric motor by means of a shaft and excentrics.

5. MANUS *milking machine* (figs. 8 and 9, constructed by the AKTIEBOLAGET MJÖLKNINGSMASKINEN MANUS, Norrköping). It is provided with four milkers, each with a plate, which presses the teats against another metal plate. The metal arms which bear these plates at their extremity are driven by excentrics mounted on a shaft, which is connected by gearing with another shaft to which the necessary power is conveyed by a flexible shaft. The shaft bearing the excentrics may be shifted at will lengthways. By this arrangement the milkers can be started and stopped while the motor is running . The pressure of the plates is regulated by springs. The metal arms carrying the milkers are pressed against the teats by spiral springs regulated by screws. The gears and shafts are well protected by an aluminium casing.

B. — *Suction machines.*

In general the suction machines are all constructed on the same principle. The teat cups adhere to the teats by suction. They are oblong, funnel-shaped and provided with double walls; an outer one of metal or other rigid substance and a flexible inner one of rubber. In the space between the two the alternation of partial vacuum and atmospheric pressure causes the rubbers to press at short intervals against the teats. This prevents the blood from flowing too abundantly to the extremities of the teats. The pressure in general is reduced to half an atmosphere. The pulsator makes from 40 to 80 strokes a minute, and generally its speed can be regulated. If the action of the pulsator is too rapid it has not the desired effect.

TABLE I. — *Most important results of the trials.*

Machines	Duration of trials	Milk obtained per cow and per day		Milk obtained per minute		Milk left in the udder by the machine at each milking, per cow	Intensity of milking of the various machines (hand milking taken = 1)	Power required	
		By machine	By hand	By machine	By hand			Number of machines	H. P.
		lbs.	lbs.	lbs.	lbs.	lbs.			
Pressure machines:									
Alfa	January-March 1899	30.6	31.2	1.12	2.16	0.61	0.52	5	0.26
Dalen	April-May 1909	32.6	35.6	1.10	2.14	1.81	0.51	5	1.30
Lindström's Omega	February-April 1910	34.8	37.0	1.19	2.27	1.43	0.52	4	0.55
» »	February 1911	35.9	37.4	1.21	2.14	0.61	0.57	4	0.55
Loquist	Decemb. 1910-Jan. 1911	35.0	35.9	0.79	1.92	1.98	0.41	4	0.25
Manus I	March 1911	34.5	56.7	1.12	2.09	0.61	0.53	4	0.50
»	February-March 1914	31.0	32.6	1.41	2.42	0.59	0.58	4	0.37
Suction machines:									
Max	November 1910	37.4	37.4	1.23	2.05	0.59	0.60	4 to 6	0.70
Wallace	April-May 1911	33.7	33.0	1.34	2.00	0.44	0.67	3 to 4	0.50
Omega	November-December 1913	35.4	35.9	1.72	2.29	0.28	0.75	4	0.49
Comor	December 1913	29.3	30.6	1.63	2.18	0.22	0.75	—	—
Manus III	February 1914	27.9	29.5	1.94	2.29	0.18	0.84	—	—

1. Max *milking machine* (fig. 10, of Giersing and Engel, Copenhagen). The teat cups are joined by rubber tubes to the milk-can placed on the ground by the side of the cow. The pulsator is attached to the lid of the milk-can.

2. Wallace *milking machine* (Bros. Bendix, Copenhagen). The teat cups and milk-cans are arranged as in the preceding machine. There is a pulsator at the bottom of each teat cup. Its pulsations are too rapid, which causes the teats to harden and their extremities to become red owing to an accumulation of blood.

3. Omega *suction milking machine* (figs. 11 and 12, constructed by the Aktiebolaget Mjölkningsmaskinen Omega, Flen). The teat cups are joined by celluloid tubes to the milk-can suspended from the cow itself. These tubes are moveable and are fixed to the can by a locking ring. The pulsator is fixed to one side of the can under the point at which the celluloid tubes enter. The teat cups are connected to the pulsator by rubber pipes. The celluloid tubes and the pulsator may easily be detached from the can. In the most modern type of these machines the can is so constructed that the celluloid tubes and the pulsator are connected to its lid.

4. Comor *milking machine* (figs. 13 and 14, of K. W. Johannsson, C. E., Stockholm). It is provided with a celluloid collecting pipe, one end of which is screwed in a case on the lid of the can. The other extremity bears a metal head with four tubulures, each of which is connected with a teat cup by a rubber tube. The pulsator is attached to the collecting pipe between the teat cups and the can, which is supended from the cow.

5. Manus III *suction milking machine* (figs. 15 and 16, constructed by Aktiebolaget Mjölkningsmaskinen Manus, Norrköping). It is provided with a celluloid collecting pipe, one end of which is connected with the lid of the milk-can by a ball joint, the other end bearing a conical tap with four tubulures joined to the teat cups by rubber tubes. The can is suspended from the cow.

Table I shows the results of the more important trials.

The cows submit to the pressure machines less easily than to the suction machines; the former also work more slowly.

The quantity of milk obtained per minute is, in general, smaller than that obtained by hand milking. With quiet cows, easy to milk, the intensity of machine milking, at least in the case of suction machines is, in general, as good as by hand milking, and often superior. The quantity of milk obtained per minute depends not only upon the manner in which the machine works and the quietness of the cow, but also on the stripping and the care of the milker. The greater the yield of a cow, the greater the quantity of milk per minute. Complete milking out by machine, to the last drops of milk, causes the quantity of milk per minute to fall.

The intensity of machine milking is determined by taking the quantity milked by hand as equal to 1 and calculating the corresponding amount obtained with a machine. The intensity of pressure machine milking ranged from 0.41 to 0.58, that of the suction machines from 0.60 to 0.84. The

intensity of machine milking increases as the cows get accustomed to it This increase is shown in Table II, and it is more visible for suction ma chines than for pressure machines.

TABLE II. — *Increase of intensity of machine milking.*

Weeks	Intensity				Milk remaining per cow and per milking			
	Manus I pressure	Omega	Comor	Manus III	Manus I pressure	Omega	Comor	Manus II
		suction				suction		
					lbs.	lbs.	lbs.	lbs.
1st	0.57	0.69	0.70	0.80	0.44	0.44	0.33	0.26
2nd	0.58	0.75	0.72	0.83	0.66	0.22	0.18	0.18
3rd	0.60	0.80	0.83	0.91	0.66	0.22	0.15	0.11

It has also been observed that the intensity can be increased by weight ing the teat cups, so that the udder and the teats are somewhat lengthened With Omega and Manus III weights of over two pounds are attached t each teat cup during milking.

Suction machines are also better with regard to stripping the cows though this depends on the temper of the individual cows and some requir always to be stripped by hand.

By using milking machines, provided they be well cleaned, a muc purer and wholesomer milk is obtained than by hand milking, but i cleanliness is neglected and the pipes and tubes are left attached to the ma chine between milkings, then machine-drawn milk contains more germ than hand-drawn milk and its keeping qualities deteriorate.

The best and simplest way of keeping the rubber tubes sweet is to was them well after using and to keep them in cold pure water until they ar again required.

The influence of machine milking on the yield compared with han milking could not be definitively determined in the trials. The yield sink more or less when machine milking replaces hand milking, but it rise again rapidly as the cows get accustomed to the machines.

214 – Review of Patents.

Tillage machines and implements.

Germany
279 325. Internal combustion traction engine for ploughing outfits.
279 920. Wheel plough with device at the rear for regulating the dept of furrow.
279 974. Forest plough.

Italy
144 525. Improvement in ploughs for direct haulage by steam or oth power.

Hungary
64 948. Improvement in two-engine ploughing outfits.
65 305. Soil leveller
65 420. Device for ploughs for regulating the depth of the furrow.

Hungary	65 457. Levers for rotary cultivators.
	65 473. Combined hoe, pick, saw and spade.
	65 627. Apparatus for regulating the paying out of wire rope for cultivators and the like.
	65 654. Automatic anchor truck for one-engine ploughing outfit.
	65 840. Rotary drum for cultivators.
United Kingdom	16 450. Motor ploughing machine with the tools fastened to endless chains carried by V-shaped frame.
	17 569. Land-levelling machine.
United States	1 115 410. Double-cut harrow.
	1 115 219. Plough blade.
	1 114 911. Double-row cultivator.
	1 115 425. Cotton chopper attachment for cultivators.
	1 115 666. Autoplough.
	1 116 302. Caterpillar for ditching machines.
	1 115 839. Double disk harrow.
	1 115 679, 1 117 400, 1 117 448. Ploughs.
	1 116 089. Gang plough.
	1 116 454. Disk cultivator.
	1 117 027. Sulky or wheel cultivator.
	1 116 594, 1 116 839. Cultivators.
	1 117 069. Cotton chopper.
	1 116 824. Subsoiler attachment for ploughs.
	1 116 997. Harrow tooth.
	1 116 914. Weeder attachment.
	1 117 328. Harrow.
	1 117 432. Motor plough.

Manure distributors.

France	472 464. Apparatus for spreading granular and powdery substances, such as manures, seeds, etc.
Germany	279 407. Device for regulating the position of the wheels, independently of each other, of manure spreaders and the like, on uneven ground.
United States	1 115 777. Combined fertilizer distributor and planter.
	1 117 028. Fertilizer attachment.
	1 116 659. Fertilizer spreader.
	1 117 460. Manure spreader.

Drills and sowing machines.

Denmark	19 508. Potato planter.
Germany	279 326. Sowing machine with fixed agitator wheel.
	279 328. Wheel for beet seeder.
	279 365. Drill and dibbler with vertically adjustable furrow openers.
	279 746. Potato planter.
	279 921. Potato planting device with horizontal wheel.
	279 922. Agitator wheel for drills.
Hungary	65 454. Force-feed shell for drills.
	64 841. Seed-covering device for drills.
	65 896. Maize planter.
United States	1 115 544. Corn planter.
	1 116 813. Planter.
	1 117 343. Corn planter attachment.

Reapers, mowers, etc.

Austria	68 100. Hay tedder.
Canada	157 302. Mower mechanism.
	157 339. Pitman mechanism.
Germany	279 839, 279 840. Hay tedders.
Hungary	65 021. Apparatus for straightening the blades of scythes.
	65 664. Elevator for mowed hemp.
United Kingdom	16 220. Lawn cutter and trimmer.
	17 876. Device for backing mowing or harvesting machines.
	18 428. Swath-turning appliance.
United States	1 114 900. Harvester.
	1 115 288, 1 115 565. Corn harvester.
	1 116 107. Machine for harvesting broom corn and the like.
	1 116 390. Motor mower.
	1 116 449. Shocker attachment for harvesters.
	1 117 904. Pea thresher and harvester.
	1 117 515. Mowing machine.
	1 117 763. Two-speed mower.
	1 117 420. Harvester reel support.
	1 117 836. Grain-shocking machine.

Machines for lifting root crops.

Denmark	19 473, 19 509. Machines for lifting root crops.
Germany	279 747, 279 838 Potato harvesters.
	279 837. Discharge wheel for potato harvesters.
United States	1 115 250, 1 117 065 Beet harvester.
	1 115 537. Potato digger.

Threshing and winnowing machines.

Canada	157 218, 157 247 Sheaf loader.
United Kingdom	18 754. Elevator for threshing machines.
United States	1 116 294. Self-feeder for threshing machine.

Machines and implements for the preparation and storage of grain and fodder.

Canada	157 012. Straw stacker.
	157 177. Weight marker for baled hay.
Germany	279 604. Cereal-cleaning machine with arrangement for shifting the riddle in the shaker box.
Italy	143 863. Esiccator for cereals.
United Kingdom	16 315. Machine for drying, cooling and cleaning grain.
	18 575 Hay lifter.
United States	1 117 460. Machine for harvesting and cutting ensilage.
	1 117 345. Fodder shredder.

Dairying machines and implements.

Canada	156 785. Milking machine.
	157 453 Milking machinery.
Denmark	19 494, 19 495, 19 503 Milking machine.
United Kingdom	16 432. Vessel for heating and storing milk.
	18 055. Churn.
	18 871. Cream separator.

Other agricultural machines.

Canada	156 699. Shock absorber for tractors.
	156 743. Truck mechanism for tractors.
	156 772. Fruit-sorting machine.
	156 884. Retting tank.
	157 062. Gate opening device.
	157 429. Clevis.
Cuba	2 125. Wind-power irrigation machines.
	2 141. Sugarcane cleaner.
	2 150. Apparatus for purifying and oxygenizing alcoholic liquids.
	2 151. Hydraulic apparatus for raising water, driven by compressed air.
Germany	279 508 Drinking troughs for horses and cattle during transport.
Italy	144 309. Sprayer.
	144 072. Sulphurer with continuously rotating agitator.
	142 529. Piston spraying pump with agitator and valves adjustable from the outside of the can.
Switzerland	67 717, 67 718 Apparatus for peeling potatoes and the like.
	67 850. Drinking trough for cattle.
United Kingdom	15 856. Incubator and foster mother.
	15 895. Fruit-cleaning machines.
	16 492. Spraying machine.
	16 894. Portable dipping apparatus for sheep, etc.
	17 217. Machine for removing the pericarps from palm and other fruit, nuts, seeds, etc.
	17 315. Nut-cracking machinery.
	17 407. Fore-carriage for agricultural machines.
	18 463. Apparatus for raising water from wells, etc., by direct air pressure.
	18 625. Spray producers for watering lawns.
United States	1 116 709. Frame for agricultural machines.
	1 117 419. Steering device for traction engines.
	1 117 477. Tractor.
	1 117 383. Disk-sharpening machine.

215 – **Turret Covered-Court for Farmyard Manure.** — CONFALONIERI, S., in *L'Italia Agricola*, Year 51, No. 12, pp. 545-548. Piacenza, December 15, 1914.

BUILDING CONSTRUCTION

One of the most interesting problems in farming is the proper storage and fermentation of farmyard manure in connection with manure pits and covered courts ; it has been the subject of much careful study and ample discussion, but it has not yet been satisfactorily solved, as both open pits and covered courts have each their advantages and disadvantages.

Dr. GIUSEPPE BECCARI, of Florence, Italy, has proposed and patented a new system of fermenting manure in so-called "turret covered-courts" (concimaia a torretta) which differ considerably from other similar structures now in use. It is based on two new principles :

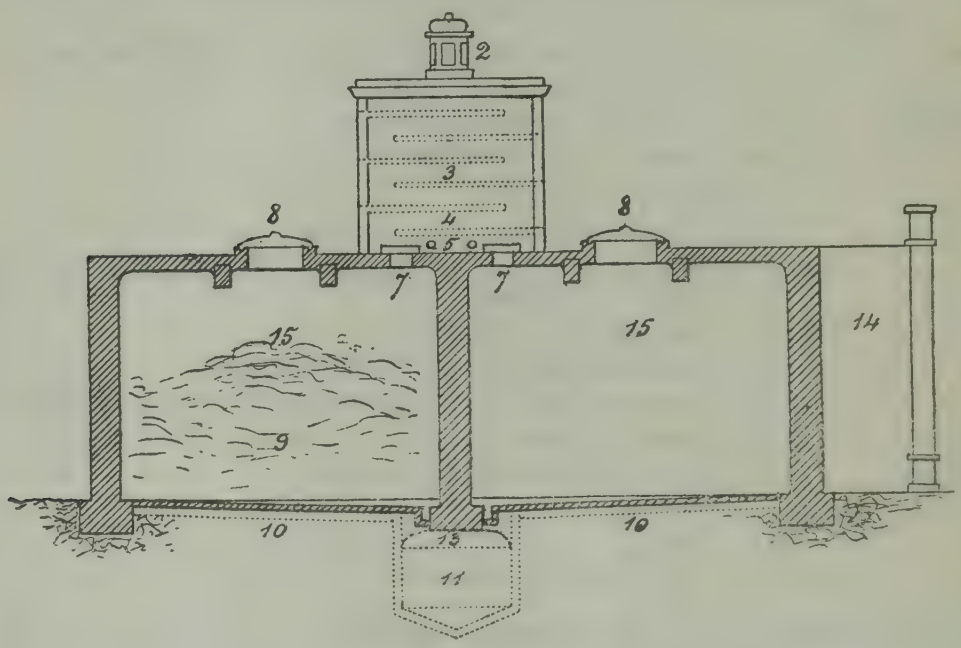
1. Of fermenting the manure in a closed space so that it attains immediately the high temperature of 158 to 167° F., evolving abundant ammonia compounds and preventing the development and action of denitrifying bacteria and consequent loss of nitrogen.

2. Of collecting the volatile ammonia compounds which in other dung-pits are, for the most part, lost in the atmosphere, while with this system they are led into a special chamber (the turret) where they are transformed

into stable ammonia salts or nitrates, by suitable absorbents, such as clayey earth, peat, charcoal, gypsum, acid superphosphates or an alkaline medium, etc., and at the same time favour the development of numerous colonies of nitrifying bacteria.

The turret covered-court (see accompanying figure) is a masonry structure rectangular in plan, of an area proportionate to the amount of manure to be treated, and divided internally into two compartments (15) not higher than 7 ft. 6 in. The floor is paved and is provided with drains covered by perforated bricks, through which air passes upwards into the dung from the ventilation drain (13), while the liquid manure oozes through it into the tank (11).

In the top of each compartment there is a trap-opening about 2ft. in diameter through which the manure is thrown as it issues from the stables.



Turret covered-court for farmyard manure.

Between the two trap-openings a masonry turret is situated, with the object of collecting and fixing the ammonia compounds evolved from the fermenting manure, which enter by the apertures (7).

In the turret a series of shelves (3), placed above each other and fixed alternately to either side so as to leave a serpentine passage for the ammoniacal vapours, are charged with solid or liquid, alkaline or acid absorbents; these are collected from time to time, through a door or other apertures in the turret, which has also the openings (2) and (5) at the top and bottom for the admission and escape of a moderate quantity of air.

The manure, as it leaves the stables, is thrown into the compartments (15) and abundantly sprinkled every 4 or 5 days with liquid manure from the tank, and in 45 to 50 days it is completely decomposed and ready for use and can be removed through the doors in each compartment.

Manure made in this way has been found to contain from 0.54 to 0.89 per cent of nitrogen, while manure made in the usual way is considered good when it contains 0.45 per cent. Besides this there is also the nitrogen fixed as ammoniacal or nitric nitrogen by the absorbents in the turret.

From the hygienic point of view also, this system is much superior to any other. It has been adopted in several parts of Tuscany, where the cost of erecting such a covered court sufficient for 8 or 10 head of cattle is about £27.

RURAL ECONOMICS.

216 – **Live Stock on Farms in the United States.** — *Thirteenth Census of the United States, taken in the year* 1910, Vol. V, Agriculture, pp. 327-472. Washington.

Live Stock. — The total value of all live stock on farms in the United States on April 15, 1910, was $4 925 174 000. Of this total, the value of domestic animals, $ 4 760 060 000, represented 96.6 per cent, and the value of poultry most of the remainder.

During the decade 1900 to 1910, the value of live stock on farms increased $ 1 849 696 000, or 60.1 per cent.

The largest absolute increases were in the West North Central and the East North Central divisions, though with respect to percentages of increase, the Pacific division ranked highest, closely followed by the South Atlantic division.

The North shows a greater absolute increase, in the value of all live stock, than either the South or the West, but the percentage of increase was somewhat lower in that section, than in either of the others, being highest in the West.

The average value of live stock, per farm for the United States as a whole, was $ 774 in 1910. The average per farm was highest in the Mountain ($ 2119). West North Central ($ 1398) and Pacific ($ 1242) divisions, but in the Mountain and Pacific divisions this was wholly, and in the West North Central division partly, due to the fact that in these divisions the average size of farms considerably exceeds the average of the United States. The only other division where farms are larger than the average for the United States as a whole is the West South Central, which ranks fourth in average size of farms, but sixth in the average value of live stock per farm. The average size of farms in the West North Central division was about one and one-half times as great as the average for the United States, while the value of live stock per farm in this division was about one and four-fifths as great as the average for the country. In the East North Central division the average size of farms was considerably less than the average for the United States, yet the average value of live stock per farm was greater in this division than for the United States. These differences indicate the very great importance of the live stock industry in these two divisions.

The average value of live stock per acre of farm land in the United States in 1910 was $ 5.60.

Horses and mules. — The total number of horses reported as on farms on April 15, 1910, was 19 833 000, as compared with 18 267 000 on June 1, 1900, an increase of 1 566 000 or 8.6 per cent. The numbers of mules at the same dates were 4 210 000 and 3 265 000 respectively, showing an increase of 945 000 or 29 per cent. For horses, mules, asses and burros combined the number increased from 21 626 000 to 24 149 000 or 11.7 per cent. There was a striking increase in the total value of each of the three classes of draft animals, between 1900 and 1910, which in turn was due primarily to the great increase in the value per head. The average value of all animals of these three classes combined increased from $50,80 in 1900 to $108.59 in 1910, or more than doubled. A similar movement took place in each class. In the United States as a whole the average value of all horses per head, in 1910, was $ 105.06, as compared with $ 124.80 for mules. The average value of "mature horses" increased from $53,03 per head in 1900 to $112.36 in 1910, and that of "mature mules" increased from $64.74 to $ 131.49.

The geographic distribution of horses is quite different from that of mules. Although the use of mules is rapidly increasing in the North, it is in the Sonth that they have been found particularly useful.

The number of farms reporting horses in 1910 was 4 692 814, or 73.8 per cent of the total number of farms in the country. The corresponding proportion in 1900 was 79 per cent. The number of farms reporting mules in 1910 was 1 869 005, or 29.4 per cent of the total, as compared with 25.8 per cent in 1900. The percentage of farms reporting horses in 1910 was highest (93) in the West North Central division and lowest (48.2) in the South Atlantic division. On the other hand the percentage reporting mules was highest (52.5) in the West South Central division, followed by those in the East South Central and South Atlantic divisions. The percentage was insignificant in the New England division and comparatively small in several of the other divisions.

In 1910 the average number of horses per farm reporting was highest (8.9) in the Mountain division and lowest (2.1) in the South Atlantic and East South Central divisions. The average number of mules per farm reporting ranged from 6 in the Pacific division to 1.6 in the South Atlantic division.

Cattle. — Comparisons between the censuses of 1910 and 1900 with reference to cattle, are affected in a more marked degree than those referring to horses and mules, by the changes introduced in the last census, in the definitions of the several classes of cattle, in view of the change in the date of enumeration. The classification of age based upon calendar years, involved radical changes in the age limits of some of the groups as compared with those employed in 1900. Instead, therefore, of a decrease in the total number of cattle from 67 719 000 on June 1, 1900, to 61 804 000 on April 15, 1910 (a decrease of 5 915 000, or 8.7 per cent), there would probably have been a decrease of not more than 3 000 000, and possibly not over 1 000 000 had the enumeration of 1910 been made as on June 1. The number of "dairy cows" reported in 1910, was 20 625 000 and the number

reported in 1900, 17 136 000 with a nominal increase of 20.4 per cent. The number of animals classed as steers and bulls declined from 16 535 000 1900 to 13 049 000 in 1910, or nominally 21,1 per cent.

The total value of cattle increased from $ 1 475 205 000, in 1900, to $ 1 499 524 000, in 1910. There was a very considerable increase in the total value of dairy cows, but a decrease in the value of all the other classes.

The average value of the aminals classed as " dairy cows " increased from $ 29.68 in 1900 to $ 34.24 in 1910.

The average number of cattle of all kinds per farm reporting, was 14.3 in 1900 and 11.7 in 1910. The Mountain division averages the maximum, in 1910, with 45.8 per farm, and the East South Central division the minimum, with 4.7. These variations can be attributed partly to the differences in the average size of farms and in the Mountain division to the large number of cattle that graze on the public domain. The variation in the number of dairy cows per farm reporting is not so marked, the number being highest in 1910 in the Middle Atlantic division, 6.5 per farm, and lowest in the East South Central division, 2 per farm. The differences indicate that in certain divisions dairy cows are kept chiefly to supply home consumption, and that in others they are kept largely to produce dairy products for sale.

A considerable difference is noted in the average values of corresponding classes of cattle in the several divisions, evidently due in part to differences in the native numbers of blooded stock and to differences in the proximity to markets for cattle or for dairy products. The average value of all cattle in 1910 was lowest in the South Atlantic division ($ 18.50) and highest in the Middle Atlantic division ($ 32.77). The value of dairy cows ranged from $ 26.30 in the West South Central to $ 43.25 in the Middle Atlantic division ; of the individual States, the District of Columbia reported the highest average value for dairy cows, $ 79.97, followed by Rhode Island, with $ 46.68 ; the lowest, $ 17.41, was reported from Florida. The average value of steers and bulls was lowest in the East South Central division ($ 19.74) and highest in the New England division ($ 40.02). In each of the geographic divisions the average value of all cattle per head was higher in 1910 than in 1900, but had there been no change in the date of enumeration, one or more of the divisions would probably have shown a decline in this average. However, despite the fact that the class " dairy cows " as defined in 1910 included some younger animals than were included in the class so designed in 1900, the average value of dairy cows per head increased in every division.

Swine. — The change in the date of enumeration from June 1 in 1900 to April 5 in 1910 had a very serious effect on the comparability of the statistics pertaining to swine in the two censuses.

The number of swine reported in 1900 was 62 868 000, in 1910, 58 186 000, a decrease of 4 682 000 or 7.4 per cent. There would, however, probably have been some increase had the census of 1910 been taken on June 1.

Despite the decrease in number reported, the value of swine increased from $ 231 978 000 in 1900 to $ 399 338 000 in 1910, or 72.1 per cent.

The average value per head was $ 0.86 in 1910 as compared with $ 3.69 in 1900, an increase of 85.9 per cent. In 1910 68.4 per cent of the farms reported swine and 64.3 per cent reported " mature hogs " and 29.4 per cent reported pigs born after January 1, 1910. The most important swine-raising State in 1910 was Iowa with 7 546 000, followed by Illinois with 4 686 000, Missouri with 4 438 000, Indiana with 3 614 000, Nebraska with 3 436 000, and Ohio with 3 106 000. The average number of " mature " swine per 1000 acres of land in farms in 1910 was greatest in the East North Central division (65), followed by the West North Ceutral division (54). The average number per 1000 acres was decidely lower in the three southern divisions, and lower still in the New England and Middle Atlantic and the two divisions farthest west. The average value of mature hogs per head in 1910 exceeded $ 10 in each of the divisions of the North, but was very much lower in the three southern divisions ; the maximum was $ 13,92 in New England, and the minimum was $ 4.94 in the South Atlantic division. The difference between the North and the South in this respect is due partly to the fact that in the North the breeding of pure-blooded hogs has produced a heavier and better animal than is usually found in the South, and, partly to the closer proximity of the northern farms to large marketing centers.

Sheep and goats. — The total number of sheep reported as on farms and ranges on April 15, 1910, was 52 448 000 as compared with 61 504 000 on June 1, 1900, a decrease of 9 056 000 or 14.7 per cent. This decrease, however, was due partly to the change in the date of enumeration.

The number of goats and kids increased from 1 871 000 in 1900 to 2 915 000 in 1910. Despite the decline in number, the values of sheep and lambs increased 36.8 per cent (*i. e.* $ 62 638 000). The value of goats and kids in 1910 was nearly twice as great as in 1900. The average value of all sheep and lambs per head rose from $2.77 to $4.44, or 60.3 per cent. Of the 6 361 502 farms of the United States, 610 894 or 9.6 per cent reported sheep and lambs. The average number of sheep and goats per 1000 acres of land in farms in the United States was 63 in 1910, as compared with 76 in 1900. The Mountain division in 1910 reported 49.2 per cent of the total number of mature sheep in the United States ; the East North Central division ranked next with 16.5 per cent, the Pacific division third with 9.5 per cent, and the West North Central fourth with 8.9 per cent. The southern divisions together reported only 11.9. The Mountain division reported in 1910 an average of 1395 sheep per farm, the Pacific division 452, while the next highest average was 110 in the West South Central division.

Poultry. — The total number of all fowls reported in 1910 was 295 880 000, of which 94.7 per cent consisted of chickens. The total value of fowls increased from $85 808 000 in 1900 to $154 663 000 in 1910, or 80.2 per cent. The average value per fowl advanced from 34 cents in 1900 to 52 cents in 1910, or 52.9 per cent.

In 1910 the average value of chickens was 50 cents ; of turkeys $ 1.79 ; of ducks, 54 cents ; of geese, 72 cents ; of guineafowls, 35 cents ; of pigeons,

28 cents; and of peafowls, $2.84. 87.8 per cent of the farms of the United States reported fowls of one or more classes.

In the United States as a whole the average number of fowls per 1000 acres of land in farms increased from 299 in 1900 to 337 in 1910. In 1910 the highest average (610) was in the East North Central division, closely followed by that in the Middle Atlantic (602). The Mountain division, with 96 fowls per 1000 acres, ranked lowest in this respect. In average value of fowls per farm, the West North Central division ranked first in 1910 with $ 43.89, though the average was almost as high in the Pacific division ($ 42.35) and in the Middle Atlantic ($41.49). It was lowest in the East South Central division.

Bees. — In the United States as a whole 3 445 000 colonies of bees on farms were reported in 1910, as compared with 4 108 000 in 1900; a decrease of 663 000 colonies, or 16.1 per cent. There was, however, a slight increase in the total value of bees, which was $10 374 000 in 1910 as compared with $ 10 178 000 in 1900, the leading States in this respect being: California with $ 728 000; Texas, $ 675 000; New York, $ 647 000; Missouri, $ 585 000; and Iowa, $517 000. The average number of colonies per farm was 5.9 in 1910, and the highest average was found in the Mountain division with 16.9.

The average value of bees per colony in the United States increased from $2.48 in 1900 to $3.01 in 1910, ranging from $4.82 in the New England division to $2.20 in the East South Central division.

217 – **Ten Years' Profits from an Apple Orchard.** — HEDRICK, P. U., in *New York Agricultural Experiment Station, Bulletin* No. 376, pp. 81-90 + 1 table. Geneva, New York, 1914.

These experiments were carried out during a period of 10 years in the Auchter orchard near Rochester by the Geneva Experiment Station. The apple trees are of the Baldwin variety and were 37 years old at the end of the experiment; that is to say they had reached their maximum productivity. The average yield per acre during this period was 116.8 barrels, of which 79.19 were packed for direct consumption and 37.61 consisted of "culls" and "drops" which were dried or made into cider. The proportion of evaporator and cider stock is high, owing to autumn gales in two seasons. The average yield per tree was 4.29 barrels, consisting of 2.91 barrels of marketable apples and 1.38 barrels windfalls. The orchard is valued at $ 500 per acre, and at 5 per cent the interest is $ 25 per acre or 21 cents per barrel. Taxes are estimated at $ 1.50 per acre or 1.2 cents per barrel. The cost of depreciation is not allowed for separately, as it appears in the salaries of the workmen, who provided their own tools. The cost of the equipment for an average orchard, including team, spraying outfit, wagon, plough, etc., would be about $ 5 000. The annual cost of tillage was $ 7.39 per acre, and the total cost of cultivation, including cover crop, pruning, spraying and superintendence, exceeds $ 74 per acre, or $ 2.7 per tree and 64 cents per barrel. The apples were sorted and packed on the orchard and hauled to a station 1 ½ miles away. The total cost

of these operations was 24.4 cents per barrel. The average price of the barrels has been 36 cents each.

Thus the cost of 1 barrel of apples delivered at the station is calculated as follows :

	$
Interest on capital	0.21
Taxes	0.012
Tilling	0.063
Pruning	0.03
Spraying	0.96
Cover crop	0.023
Superintending orchard	0.25
Picking, packing, sorting and hauling	0.244
	$ 1.79

During this period of 10 years the average price of apples was $ 2.60 including first and second quality, and 72 cents for evaporator and cider stock. Subtracting the cost of a barrel of apples ($ 1.29) from $ 2.60 (the selling price), there remains a net profit of $ 1.31 per barrel, or $ 103.49 per acre. Since no barrels are required for the culls, the cost per barrel quantity is 93 cents, which, subtracted from tbe selling price of 72 cents, leaves a net loss of 21 cents per barrel. Multiplying by 37.6, the number of barrels of culls per acre, the loss per acre on the culls is $ 7.89, thus leaving the average net profit per acre in this orchard at $ 95.60. Adding to this the $ 25 interest on the investment, we have $ 120.60 net or 24.12 per cent on $ 500 as the annual 10-year dividend.

Although the profits of this orchard are many times as great as those from the average plantation in New York, they are not abnormal for a well-managed orchard in this State.

AGRICULTURAL INDUSTRIES

INDUSTRIES DEPENDING ON PLANT PRODUCTS

218 – **The Production of Wine in Austria.** — PORTELE, K., in *Allgemeine Wein-Zeitung*, Year 31, No. 51, pp. 565-568. Vienna, December 17, 1914.

The following table gives: 1) the average annual production of wine in the different provinces of Austria during the eleven years 1903-1913; 2) the production during 1914 from estimates made after the vintage (1).

(1) The figures in gallons are only approximate, representing the figures in hectolitres × 22. (*Ed.*).

Province.	1903-1913 Average yield — gallons	1914 Estimated yield — gallons
Lower Austria	19 550 322	15 094 684
Styria	17 457 132	13 024 000
Carinthia	2 464	2 640
Carniola	4 535 960	5 835 500
Tyrol	19 631 172	17 310 788
Vorarlberg	15 334	?
Goritz and Gradiska	5 598 912	5 060 000
Trieste	156 200	169 400
Istria	10 924 606	7 158 800
Dalmatia	20 934 078	23 849 100
Bohemia	226 072	132 000
Moravia	3 447 906	814 000
Total . . .	102 480 158	88 450 912

219 – **Treatment of the Disease of Wines known as "Casse" by Means of Wine Lees.** — PORCHET, F., in *Le Progrès Agricole et Viticole*, Year 35, No. 49, pp. 536-538. Villefranche (Rhône), December 6, 1914.

" Casse " is a disease of wines which causes alterations in their colour and taste. The writer describes a method of controlling it which is very popular in the vineyards of the Canton Vaud (Switzerland), but is not much known in France.

It is a preventive treatment, consisting in separating the wine as soon as possible from the fine lees, that is their upper layer which contains the germs which in developing cause diseases in wine. This upper layer is easily removed by a little board fixed at right angles to the extemity of a stick. The fine lees being removed, the coarser ones are then taken out of the cask, mixed immediately with some of the wine to be treated and poured back again into the mass of wine. The whole is then well beaten up with a whipper or chain so as to obtain an intimate mixture of wine and lees, and in most cases this will be sufficient.

In order to ascertain if a wine is subject to the disease and if this treatment with coarse lees has to be practised, it will be enough to draw a sample of a few gills from each cask and to expose it to the air for a day or two at a moderate temperature. If the wine turns brown throughout or even only on the surface, it is a sign that the wine will suffer from the oxidasic " casse'. The treatment must be applied from the end of November to the end of December. Later it is liable to communicate a slight taste of lees to the wine. It will be the same if the lees are not mixed with the wine to be treated immediately on being taken out of the cask, for under the action of the air they rapidly contract an unpleasant flavour which they impart to the wine.

220 – **Milling and Baking Qualities of Victorian Wheat** (1). — RICHARDSON, A. E. V.; SCOTT, P. R.; and WINSLOW, F. G. B.: in *The Journal of the Department of Agriculture of Victoria*, Vol. III, Part 9, pp. 538-545 + 3 plates; Part 11, pp. 668-675. Melbourne, September and November 1914

Following the policy adopted last season the standard f. a. q. (fair average quality) wheats fixed by the Chambers of Commerce of the four wheat States of the Commonwealth were first examined in order to establish a basis of comparison for locally-grown pure types and also to secure definite analysis of the f. a. q. samples from year to year. The f. a. q. standards are fixed each season by the Chambers of Commerce and are obtained by mixing a large number of representative samples from the principal wheat-growing districts in each State in parts proportional to the production of each district.

The percentages of impurities were : 0.61 for Western Australia, 0.71 for New South Wales, 0.79 for Victoria and 0.92 for South Australia; these figures are considerably higher than those of the preceding year. Assuming an export of 20 million bushels each from New South Wales and Victoria, and 10 million bushels each from Western Australia and South Australia during 1914, the amount of impurities exported with the wheat crops is approximately 12 000 tons, the freight of which would amount to £ 18 000. All the f. a. q. samples contain bunty grains in greater proportion than last year.

The percentage of grains of first quality (*i.e.* those large enough to be retained by a 3.25 mm. sieve and yielding a much higher percentage of flour) was 60.1 for New South Wales, 54.8 for Victoria, 43.0 for South Australia, and 56.6 for Western Australia. In the preceding harvest 1912-13, the percentages for the first three States were : 62.2, 70.8, 59.5 respectively. Thus, the percentage of first-quality grains was considerably lower than in the preceding year, the difference being particularly large in the case of South Australia and Victoria, probably owing to the abnormally dry season.

The amount of screenings — cracked and pinched grain not retained by a 2.0 mm. mesh — was increased to an average of 4.4 per cent, which on the total weight of wheat exported corresponds to 70 714 tons.

The average of the f. a. q. samples of wheat contained 9.16 per cent moisture, 1.86 per cent nitrogen, 11.6 per cent crude protein. A composite sample of flour made from a mixture of the wheats of the four States contained 1.65 per cent gluten, a water-absorption capacity of 45.8 quarts of water per 200 lbs. sack of flour, and a bread-making capacity of 290 lbs per sack. Whilst the moisture content was almost the same for standard flours of the four States, there were notable differences with regard to other characters. The strength in albuminoids and dry gluten was 11.65 and 10.78 per cent respectively in the flour from New South Wales ; 10.53 and 10.13 per cent in the case of South Australia ; 9.72 and 8.78 per cent for Western Australia ; and 9.25 and 8.51 per cent for Victoria.

(1) See also No. 164 above. (*Ed.*).

II. — Twenty-eight varieties of wheat and twelve new crossbred wheats from Dookie College were submitted to milling and baking tests. Wide fluctuations were observed in prolificacy, bushel-weight, strength and colour of flour and content of gluten, nitrogen and protein; thus the minimum yield was 20 bu. 28 lbs. from Minnesota 163, and the maximum yield 37 bu. 31 lbs. from College Eclipse; the minimum bushel-weight was 61.8 lbs. for Minnesota 163 and the maximum 66.2 lbs. for Bayah; the minimum water absorption capacity was 42.2 quarts per sack (200 lbs.) for King's Early and the maximum 52.6 quarts per sack for Bobs; the gluten content of the flour varied from 1.36 per cent in Federation to 2.07 per cent in Minnesota 163; the crude protein varied between 8.5 per cent for Federation and 12.93 per cent for Minnesota 163. The most suitable varieties for milling gave the poorest yields and, *vice versa*, the most prolific and commonly grown wheats gave relatively poor results in the mill and bake-house. Climate or seasonal conditions and soil undoubtedly play an important part in determining the milling quality, but it is noteworthy that the same varieties showed the same relative difference at the centres tested. Quality in wheat is therefore a fixed and inherent characteristic of the variety.

The varieties grown at Longerenong were slightly inferior in strength but considerably higher in protein and gluten content than the same varieties grown at Rutherglen. This increased protein content is probably accounted for by the higher nitrate content of Longerenong soils throughout the whole period of growth, due to the greater vigour of the nitrifying organisms in the soil.

The varieties Bobs, Jonathan and Comeback gave flour of high strength and are not valuable varieties for blending. The varieties Genoa, Thew, Warren and Zealand Blue were found to be of medium strength and good milling quality. The varieties Bunyip, Cleveland, College Eclipse, Triumph, and Yandilla King have fair strength and their milling and baking qualities are satisfactory. The varieties Bayah, Dart's Imperial, King's Early, Federation, Gamma, and Viking are of low strength and were below the f. a. q. standard. The majority of Australian types produced flour of excellent colour, contrasting strongly with such durum wheats as Huguenot and introduced types such as White Fife, Minnesota and American.

BIBLIOGRAPHICAL NOTE.

221 – MINISTERO DI AGRICOLTURA, INDUSTRIA E COMMERCIO, UFFICIO DI STATISTICA AGRARIA. — *Il vino in Italia, Produzione, Commercio con l'estero, Prezzi* (The Production, External Trade and Prices of Wine in Italy), pp. VIII + 91 + 1 table. Rome, Cecchini, 1914.

This brochure consists of two parts, each containing two chapters, subdivided as follows:

PART I. — Chapter I. *Production of grapes:* 1) extension of vine cultivation; 2) total yield of grapes; 3) distribution of the zones of vine cultivation in mountains, hills and plains; 4) distribution of vine cultivation in the various provinces; 5) table grapes. — Chapter II. *Production of wine:* 6) yield of grapes as wine; 7) influence of the methods of vinification on the yield of wine; 8) yield of wine in the various provinces during the five years 1909-13; 9) alcoholic strength of wines.

PART II. — Chapter I. *Statistical data of the foreign trade:* 1) present yield of wine in the chief producing states; 2) data on the world's production of wine before 1900; 3) data on the consumption of wine in Italy; 4) foreign trade in Italian wines; 5) comparison between Italian, French and Spanish wines in the World's markets; 6) foreign trade in wine-grapes; 7) foreign trade in table grapes; 8) trade movements in different months. — Chapter II. *Statistical data on the price of wines:* 9) dutiable values; 10) data concerning the price of wine on some of the principal Italian markets; 11) average monthly prices of wine in 1912 and 1913.

Vines are grown in Italy most extensively in the hilly districts, which yield $^4/_7$ of the total production. The yield of grapes varies considerably in the various provinces, exceeding 600 000 tons per annum in the province of Alessandria and falling below 10 000 tons in the province of Belluno. Vine cultivation with associated field crops occupies about 8 567 500 acres and is predominant in Northern and Central Italy and in Campania. In the South and in the islands vines are almost exclusively grown alone; such cultivation occupies about 2 200 000 acres in the whole kingdom. The yield of table grapes is about 50 000 tons, not reckoning the quantity of wine grapes consumed direct during the vintage, which is estimated at 150 000 tons.

It is estimated that 6 755 000 tons of grapes were transformed into wine each year during the quinquennial period 1909-13, corresponding to a yield of 1 012 788 000 gallons, or an average yield of 67 per cent. Red wines constitute 73 per cent of the total production, or 741 549 000 gallons, of which 241 218 000 contain less than 10 per cent of alcohol and 500 331 000 contain 10 per cent or more. White wines constitute 25 per cent of the total, or 251 981 000 gallons, of which 103 904 000 have less than 10 per cent of alcohol and 148 077 000 contain 10 per cent or more. Special wines (marsala, vermouth, liqueurs) make up 2 per cent, or 19 257 000 gallons. The internal consumption, estimated at 28.6 gallons per head per annum, amounts to 96 per cent of the total production, only 4 per cent being exported. In the world's production of wine, France reaches 34 per cent, Italy 28 per cent and Spain 11 per cent. The production of wine in the various regions of Italy during 1909-13 was distributed as follows:

	thousand gallons.
Piedmont	136 159
Liguria	15 252
Lombardy	48 486
Venetia	63 144
Emilia	119 179
Tuscany	91 029
Marches	52 447
Umbria	27 929
Latium	50 423
Abruzzi and Molise	41 399
Campania	103 948
Apulia	114 601
Basilicata	9 816
Calabria	20 161
Sicily	102 450
Sardinia	16 353
Total	1 012 788

BIBLIOGRAPHICAL NOTE.

222 – DELBRÜCK (Geheimer Regierungsrat, Professor an der Königlichen landwirtschaftlichen Hochschule und Vorsteher des Instituts für Gärungsgewerbe zu Berlin). *Illustriertes Brennerei-Lexicon* (Illustrated Dictionary of Distillery). Berlin, Paul Parey, 1915. (1 vol., 687 pp. + 65 plates + 622 illustrations).

This dictionary embraces the following subjects :

Distillery of potatoes and of wheat ; Manufacture of dry yeast ; Preparation of starch and its products ; Drying of potatoes ; Manufacture of brandy (eau de vie), of liqueurs, and of vinegar.

An account is given of the theoretical and practical knowledge which has been acquired, as a result of special scientific and technical investigations carried out by the Institute for Fermentation Industries (Institut für Gärungsgewerbe zu Berlin), of which the writer is the Chief. The selection of articles has been made on the basis of a carefully prepared preliminary work in such manner as to provide answers to any scientific or practical questions which may arise in connection with distillery. The book is in no way intended to be used as a text-book, but merely as a practical work of reference. The historical section deals with the evolution of the industry in its scientific, technical, and economic aspects and gives biographical notices of the investigators in this branch of science. Thanks to the aid of a considerable number of collaborators, among whom may be specially mentioned the teaching staff of the Institute, it has been possible to deal competently with each special subject considered.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

223 – **Inspection of Milk and of Milk Products in Portugal** (Communication presented to the Tenth International Congress of Veterinary Medicine in London, August 4, 1914) in *Revista de Medicina Veterinaria*, Year 13, No. 152, pp. 229-234. Lisbon, October 1914.

The official inspection of milk and dairy produce was instituted in Portugal by a Decree dated December 23, 1899, and the regulations concerning it were issued in the Decree of September 14, 1900. Since then some modifications have been introduced.

The inspection is entrusted to the Government and the Municipalities ; it is however conducted regularly only where adequate official laboratories exist, namely in Lisbon, Oporto, Coimbra and Angra (Azores).

The samples, collected by agents in the places where milk is sold, are first subjected to a superficial physical analysis and then to chemical analysis. In 1900, when the inspection of milk commenced, the law required the fat content of milk to be not less than 2.7 per cent and the total solids not less than 8 per cent. The law of December 17, 1903, however, raised these limits respectively to 3 and 8.5. The same law determines the limits of the quantities of the substances that enter into the composition of butter and considers it to be adulterated when the Zeiss-Wollny refractometer marks more than 52.5 at 25° C., when the Reichert-Meissl value is below 24° and the saponification value is below 220.

The cows that supply the large centres of population belong for the most part to the Black-spotted Dutch breed imported about the middle of the eighteenth century and called " turina " in the country. These cows in

adapting themselves to their new surroundings have diminished their lactation period to 225 days, and their yield to 6270 lbs. per annum, against 10 months and 11 000 lbs. respectively in their country of origin. On the other hand the fat content of the milk has increased to 3.7 and 3.9 per cent, against 3.5 in their old home. In Lisbon and neighbourhood there are about 10 000 " turina " cows, which produce about 62 700 000 lbs. of milk, of which about 34 300 000 lbs. are consumed as such and the remainder is used for the manufacture of butter and cheese.

Cow's milk is sold in Lisbon ar about 1*s* 9½*d* per imperial gallon; goat's milk at 2*s* 2*d* per gallon ; of the latter the city consumes 800 000 lbs. per annum. In Oporto cow's milk fetches from 1*s* 1*d* to 1*s* 5*d* per gal. In the best milk dairies in Lisbon pasteurization and sterilization are practised.

The official inspection of milk is founded on chemical analysis ; but as this was insufficient, the Portuguese Society of Veterinary Medicine proposed a reform of the present system of inspection, pointing out the lines which should be adopted and which are described in this report.

In 1913 Doctor MARRECAS FERREIRA analysed biochemically the milk that is consumed in Lisbon, and determined the reductase and catalase. Out of 101 samples from different sources that were analysed, 23 were found irreproachable, while the others should have been rejected. In 1900 the veterinary professors BORGUES and AGUEDA FERREIRA analysed during 9 months 164 samples of milk consumed in Lisbon and found that the highest number of bacteria observed was 771 000 000 per cc. and the lowest 73 000; the average number was 23 701 278. Acid-producing bacteria were in prevalence.

Similar investigations were carried out at Oporto during 14 months on 56 samples. The work began in November 1909. The greatest number of germs observed was 46 800 000 per cc., the smallest 10 000, and the average 3 113 558. These numbers seem to show that at Oporto milk is produced and preserved better than in Lisbon, but it must be borne in mind that the areas of production and distribution of milk are much more limited at Oporto, so that the milk rarely has the time to spoil during carriage.

224 – **Factors Influencing the Bacterial Content and Preservation of Eggs.** — BUSHNELL, L. D., and MAURER, OTTO, in *Kansas State Agricultural Experiment Station, Bulletin* No. 201, pp. 751-777. Manhattan, Kansas, June 1914.

The loss due to unsound eggs in the United States has been estimated at not less than 17 per cent of the total value, or about 45 million dollars per annum. With a view to diminishing this loss, researches were made to determine what factors and what conditions give rise to the deterioration of eggs. The bacter al changes are particularly studied in this bulletin.

In order to answer the fundamental question whether the infection causing the decay of eggs occurs before or after they are laid, or in other words, if the decay is due to a lack of vitality, to disturbance of the digestive organs of the fowl and to other factors favourable to infection during the formation of the egg, or, on the contrary, to defective manipulation of the eggs, the writers have compared the bacterial content and the power

of preservation of fresh eggs produced under different conditions of feeding, etc., with those produced under standard conditions ; such eggs have also been subjected to various manipulations occurring in commerce.

The conclusions arrived at are as follows :

1. Almost all eggs containing bacteria were infected in the yolks. In very few cases were the whites infected. Only a small number of the bacteria present showed any growth at blood temperature (38° C.), though they grew readily at ordinary room temperature (20° C.). This is of special interest with regard to the incubation of eggs.

2. The number of infected eggs increased slightly with the age of the fowl.

3. The eggs of different fowls showed considerable differences with regard to bacterial numbers and keeping qualities. Considering only eggs laid between March 2 and October 11, the highest and lowest percentages during the period of preservation were : for infected eggs 15 to 42, and for decayed eggs 4 to 34.

4. The eggs laid by the same fowl differed considerably in their bacterial content and preservation at different periods and without apparent cause.

5. With fowls in the open air, the number of infected eggs diminished.

6. Feeding with soft foods caused an appreciable increase in the number of infected eggs. This increasing infection was due to bacteria capable of developing at blood temperature.

7. Fecundation of the fowls did not increase the infection of the eggs as tested by the methods of the writer (*i. e.* external sterilisation of the eggs and separation of the yolks and whites in an Erlenmeyer flask under rigorously sterile conditions, with incubation at 38° C. for 48 hours and at 20° C. for 5 days, and subcultures on agar plates). It is therefore concluded that the increased decay of fertile eggs is a direct or indirect consequence of the development of the embryo. Further, another cause of loss of keeping qualities is the presence of blood rings on the shell, etc., and the presence of a dead embryo appears to increase the susceptibility of the egg to decomposition.

8. The writers have observed considerable differences between the number of infected eggs and the number of spoiled eggs. An increase in infection is not necessarily associated with a decrease in the keeping quality of the eggs, since the latter depends more on the nature than on the number of the bacteria.

9. Though the number of infected eggs does not show much variation during the period May to October, the percentage of spoiled eggs reaches a maximum in July and August and then declines rapidly.

10. The ratio between the coagulable and uncoagulable nitrogen does not indicate any marked influence upon the keeping quality of the eggs produced under the various conditions (*i. e.* presence or absence of fertilisation, kind of food given, seasonal changes). This method of determining the amount of decomposition of eggs by means of the ratio of the coagulable to the uncoagulable nitrogen may find useful application in grading

such products as frozen desiccated eggs. During decomposition the quantity of uncoagulable nitrogen increases and the ratio diminishes.

11. Several fowls were fed on a diet consisting chiefly of lucerne but without the production of so-called "grass-eggs", *i.e.* eggs with a greenish discoloration in the albumen due to a bacterial pigment produced by such organisms as *B. pyocyaneus, B. fluorescens liquefaciens*, etc.

Although infection was frequent, no pigment-producing organisms could be isolated.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

225 — **Cold Storage for Tropical Fruits.** — WILCOX, E. V., and HUNN, C. J., in *Hawaii Agricultural Experiment Station, Honolulu, Press Bulletin*, No. 47, pp. 12. Honolulu, October 10, 1914.

In the experiments reported in this bulletin a study was made of the effect of cold storage on star-apple (*Chrysophyllum cainito*), avocado, fig, papaya, water-lemon (*Passiflora laurifolia*), strawberry guava, pineapple and mango, and also upon the eggs and larvae of Mediterranean fruit-fly in these fruits. Three refrigerator rooms were used, the average temperatures being 32° F. (30° to 33°) ; 36° F. (33° to 38°) and 45° F. (40 to 47°) respectively. The air was reasonably dry in all three rooms.

The results obtained led to the following conclusion :

1. Star-apples intended for cold storage should be harvested in a half-ripe condition, cured in a well-ventilated room for about two days and held at 32° F. for not more than three weeks. A discoloration and fermentation of the pulp begins sooner in fruit infested with fruit-fly than in uninfested fruit.

2. Figs, even when picked in a ripe condition, appear to be adapted to cold storage at 32° F. for a period of about one month. As a result of refrigeration the pulp is firmer and more attractive in appearance than when freshly picked from the tree and the flavour is about equal to that of the freshly picked fruit.

3. Papayas do not seem to be particularly adapted to cold storage on account of the tendency to the development of moulds. The common mildews or moulds grow very rapidly in the dry papaine or juice of the papaya, which exudes from minute skin punctures. It is practically impossible to find a papaya fruit without skin punctures, on account of the great delicacy of the skin. Even small grains of sand carried by the wind abrade the fruit. The juice exudes at once and dries, and in this material moulds rapidly develop. Furthermore there is little necessity for holding papayas in cold storage except for trasportation, since the fruit ripens the whole year round.

4. Water-lemons seem to be the best adapted to cold storage preservation of all the fruits used in these experiments. After being kept for 3 months in cold storage they were found to hold their flavour and physical appearance for 4 days after removal from refrigeration.

5. The strawberry guava is not well adapted to cold storage. Practically all the fruit was shrivelled and fermented or decayed within one month in both the 32° and 36° F. rooms. Mildew developed abundantly

on the rind and only a few fruits kept their normal flavour and appearance more than two weeks.

6. Mangos appear to be quite suitable for cold storage. Mango No. 1977, some of which were picked in a perfectly ripe condition, preserved the normal texture and flavour for a period of 35 days. The flavour of the green fruit was perfectly preserved for a period of 2 months and no fermentation or other change took place in the fruit within 2 days after removal from cold storage.

7. Half ripe and ripe pineapples may be held in cold storage at a temperature of 32° F. without harm to the colour or flavour of the pulp of the fruit. The only change is a slight deadening of the colour of the rind.

8. The avocado seems to be well adapted to cold storage at a temperature ranging from 32° to 36° F. for a period of at least 2 months.

Effect of cold storage on germination of seed. — Seeds from several varieties of star-apple were planted after the fruit had been in cold storage various lengths of time. Seed from fruit held at 45° F. for various periods up to 25 days germinated promptly to the extent of 90 per cent. Seed from fruit held for more than 30 days in cold storage failed to germinate at all. Similarly with seed of avocados, no germination took place from fruit held longer than 20 days at a temperature of 32° F.

Efffect of cold storage upon Mediterranean fruit-fly. — A quantity of infested mangos and citrus fruits were placed in storage at 32° and 36° F. during different periods and then removed for incubation. In this test no adult flies emerged from fruit which had been stored at a temperature of 32° F. longer than 2 ½ days, and no flies emerged from fruit which had been held at a temperature of 36° F. longer than 4 ½ days. In another experiment small glass jars of moist sand containing larvae were stored at the above temperatures for 4,7, 11 and 14 days. Of those kept at a temperature of 32° F. only two larvae pupated after 4 days storage, the others being killed. In the jars stored at 36° F. the larvae were alive after 3 days and some after 7 days, but all were dead after storage for 11 days. Only one adult fly was produced from the larvae stored in sand. In these experiments the fruit-fly larvae and eggs failed to live through an exposure in cold storage at 36° F. for longer than 4 ½ days. This period cannot, however, be regarded as an outside limit.

Since May 1913, BACK and PEMBERTON have been conducting similar experiments with fruit-flies in cold storage.

Experiments on pickling avocados in salt brine for one month have given unfavourable results. Though the colour, texture and appearance were unchanged, the flavour was flat and disagreable.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

226 – **On Chlorosis in Plants.** — MAZÉ, P., in *Comptes rendus hebdomadaires des séances de la Société de Biologie*, Vol. LXXVII, No. 31, pp. 539-541. Paris, 1914.

The preceding researches of the writer (1) have shown that chlorosis can be produced experimentally in maize (*Zea mays*) by depriving the plant of sulphur or of iron ; the omission of manganese from the nutritive solution produces a partial decoloration of the leaves.

The first disease quickly disappears on providing the plant with the missing element, by applying it in the form of a very dilute solution to the blade of the discoloured leaf. The second disease does not yield to the action of manganese applied in the same manner ; but one drop of liquid exuded from the leaves of healthy plants will give the discoloured paranchyma a bright green colour in sunlight. Thus the liquid exuded by healthy plants contains an organic substance which cures diseased cells.

The active substance is specific : the exudations of cabbage, poppy and millet have no effect on this form of chlorosis in maize.

Thus, it is clear, there are several kinds of chlorosis which are distinguished from one another by their determining cause and by the treatment which causes their disappearance.

The most common form is due to lack of iron. This element, however, is very plentiful in the different kinds of arable soil. But limestone locks it up and hinders its absorption by a great many species of plants by alkalising the excretions of their roots.

The carbonates of the alkaline earths without exception provoke chlorosis in plants susceptible to it. But it often happens that refractory species become chlorotic even in soils poor in lime. These anomalies form the subject of this article.

(1) See also *B.* June 1914, No. 503. (*Ed.*).

Transplanting may determine them: this operation destroys a large number of the fine rootlets bearing the absorbent hairs. Now, it is just these hairs which also constitute the excretory organs of roots and which render soluble the mineral elements necessary to the plant. Transplanting thus deprives the plant of certain indispensable substances, and especially of iron. This can easily be proved by placing upon chlorotic leaves a nitrogenous solution of iron of $^1/_{2000}$. But the leaves become green again of their own accord as soon as the network of rootlets has reformed. Copious watering with a view to bringing about the recovery of the leaves only makes matters worse, since thereby, if the soil is rich in lime, the complete precipitation of the iron and its absorption by the calcium carbonate is brought about as the soil regains its usual amount of humidity ; if the chlorosis persists, gardeners cure it successfully with a solution of sulphate of iron.

Cryptogamic diseases also promote chlorosis, even where the roots remain intact. Fungi are in fact active destroyers of organic acids ; if the acidity of the descending sap is diminished, the excretions of the refractory plants become alkaline and their roots incapable of dissolving oxide of iron. The writer has observed the occurrence of chlorosis on maize plants cultivated in an aseptic solution each time that the base of the culm was attacked by fungi, and especially by *Penicillium glaucum*. The decoloration of the leaves is sometimes complete. When the surrounding temperature rises above 30°C., the chlorosis disappears of itself, for high temperatures hinder the growth of the fungus and promote that of the maize.

Alkaline carbonates act in the same manner as the carbonates of the alkaline-earths, but more energetically.

Maize is refractory to the action of limestone ; it becomes chlorotic in solutions rendered slighty alkaline by the addition of potash or soda.

Plant ash is very rich in alkaline carbonates, and forms an excellent manure, but if it is applied in too large quantities,it gives rise to chlorosis and often causes the death of the plants.

The alkalinity of the soil plays a large part in the absorption of iron by plants. The same may be said for manganese. Under natural conditions, it is always the want of iron that makes itself felt, since plants require more iron than manganese.

The chlorosis observed by the writer on depriving the maize of manganese is, further, of a special kind. He has succeeded in reproducing it in plants of maize supplied with a complete nutritive mineral solution by exposing them to insufficient light. Out of 10 clearly etiolated plants, 3 showed symptoms of chlorosis identical with that caused by the use of a solution lacking manganese. This disease is thus a characteristic of a pathological condition apparently due to various causes.

The special action of the exudation of healthy plants upon diseased individuals shows that plant cells, like the glands of certain animals, produce substances possessing special physiological properties.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

227 – **The Hibernation of the Powdery-Mildew of the Vine *(Uncinula necator)* in Hungary** (1). — IBOS, JOSZEF, in *Borászati Lapok*, Year 46, Nos. 50, 51 and 52, pp. 703-704, 712-713 and 728-729, 8 figs. Budapest, 1914.

The question of the manner in which the powdery mildew of the vine (*Uncinula necator*) passes the winter is still more or less unexplained, both in Hungary and elsewhere. In Hungary, the appearance of perithecia was recorded for the first time by ISTVÁNFFI, who found them on November 4, 1908, on grapes of the Marton vine in the Alsó-Gád vineyard at Hegyalja (Transylvania).

In 1913, in visits paid to the vineyards of Badacsony and the neighbourhood from August 29 to September 10, the writer observed the presence of powdery mildew, which had caused considerable injury to the bunches of grapes. At his request, a vine grower sent him on November 2 of the same year, nearly a thousand leaves of different vines affected by the disease, collected during the autumn. On submitting these leaves to a minute examination, the writer found a large number of perithecia on the mildew patches. This unusually rich formation of perithecia was due, in his opinion, to the great variations of the climatic conditions in 1913 (the summer being cool and wet and the autumn somewhat dry and warm). A description is given of the perithecia found in the mycelial covering of the lower surface of the leaves from the Badacsony vineyards.

DISEASES OF VARIOUS CROPS

228 – ***Phytophthora faberi* on Cacao in San Tomé and Principe** (2). — CARVALLO DALMEIDA, J. E., *Boletin Oficial de la Secretaria de Agricultura, Comercio y Trabajo*, Year IX, Vol. XVII, No. 3, pp. 213-216. Havana, 1914.

Phytophthora faberi, known in San Tomé and Principe under the name "negro de la mazorca" (blackening of the fruit), is the cause of a very serious disease which attacks the cacao pods when they are in full growth, or already completely developed and about to ripen.

This disease may be said to be prevalent in the plantations of the two islands throughout the year ; it is, however, worse in the dampest districts which are subject to thick fogs, and especially during the rainy season (September to May). The damage caused by this fungus is enormous, especially in the very damp districts of the south and in plantations where the trees are thickest.

The remedies adopted against this *Phytophthora* are spraying mixtures with a copper base. In the island of San Tomé, experience has shown that with applications of neutral Bordeaux mixture at 2 or at most 3 per

(1) See also *B.* March 1912, No. 575. (*Ed.*)

(2) See also *B.* Jan. 1911, No. 316; *B.* Dec. 1914, No. 1686; *B.* Sept. 1913, No 1107. (*Ed.*)

cent, it is possible, and relatively easy — if not to cure the disease on the fruit — at least to prevent the invasion of the parasite, or hinder its spread. Hence the necessity and advantage of preventive measures, which should be taken when the state of the atmosphere is such that the attacks of the parasite may be anticipated, or at the latest, as soon as the disease begins to manifest itself.

To increase the adhesiveness of the mixture, which is easily removed from the cacao fruits by the frequent and very heavy rains, it is well to add a gelatinous substance.

229 – **" Apple Cracking " and " Apple Branch Blister " caused by *Coniothecium chomatosporum* in South Africa.** — VAN DEZ BIJL, PAUL A., in *The Agricultural Journal of the Union of South Africa*, Vol. VIII, No. 1, pp. 64-67, figs. 1-6. Pretoria, July 1914.

Attention was often drawn in 1913 and 1914 to the injury done by *Coniothecium chomatosporum*. The presence of this fungus on apples in South Africa and the fact that it causes apples to crack were first recorded by I. B. POLE-EVANS.

On the branches, the disease shows as small dark specks usually aggregated together, or reddish brown irregularly raised blisters are the result. On the fruit, it causes " russeting ", producing a hardening of the cells in the attacked region, so that when the apple swells, cracks are produced.

Naturally the fact of apples showing cracks does not necessarily imply the presence of the fungus, as they may be occasioned also by uneven growth of the fruit due to climatic conditions.

The pruning back and destruction of badly diseased branches is advised as the best method of controlling this disease. Affected portions should not be left in the orchard, and should be burnt to lessen infection.

Further, before the trees begin to bud, it is advisable to treat them with a purifying spray of 1 lb. of sulphate of copper in 25 gallons of water. After this treatment, the trees should be sprayed three times with Bordeaux mixture (4-4-50 formula) at the following periods : after the leaves have expanded and before the flower buds open; when the petals begin to drop and before the calyx lobes close; when the fruits are about the size of a walnut.

The best methods of control are the removal of all infected material, pruning back of all seriously affected branches, together with a thorough cleansing spray in winter.

230 – **The Bacterium *Microspira carcinopaeus*, the Cause of a Canker on Oaks.** — RÉGAMEY, RENÉ, in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 2nd Half-Year, Vol. 159, No. 22, pp. 747-749. Paris, 1914.

The writer has studied from the bacteriological point of view some proliferous tumours (of which the appearance is very different from that of galls due to insects) observed on a young oak tree in the park of Versailles.

Fragments of the largest tumour were placed in a broth medium ; after two days, the latter already contained very numerous motile vibrions

attributable to the species *Microspira carcinopaeus*; these the writer was able to isolate as a pure culture.

In order to determine whether this bacterium was the cause of the disease observed on oak. M. RÉGAMEY made a series of inoculations, not only on *Quercus*, but also on *Tropaeolum* and *Hedera*. Perhaps on account of faulty technique, the results obtained were negative in the case of *Quercus*, but they were positive with *Tropaeolum* (18 times out of 20) and *Hedera* (5 times out of 6). By this means, the writer obtained the formation of a primary tumour at the place of inoculation, and later, secondary tumours from the proliferation of the first in the axils of the leaves, and even on the leaves themselves (on *Tropaeolum*). The parasite is intracellular in the tumours and is represented there by very few individuals.

Microspira carcinopaeus differs from *Bacterium tumefaciens* (1) in its shape, dimensions, the presence of a vibratile cilium and in its physiological reactions. The process of the formation of secondary tumours also differs in the two cases.

231 – ***Plowrightia virgultorum* on Birches (*Betula* spp.) in Great Britain.** — MASSEE, G., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 9, pp. 322-323, 5 figs. London, 1914.

In many parts of Scotland, birches (*Betula* spp.) are at the present time attacked to an unusual degree by *Plowrightia virgultorum* (Fr.) Sacc.

The disease, described by the writer under the name of " black knot " of birch, was already known in Finland, Sweden, Germany and Switzerland, and is also probably common in England. Examples of the ascomycete which produces it have been collected in Kent (at Eltham) and in Yorkshire.

The fungus attacks the twigs and branches of from 1 to 4 years of age, into which it penetrates by means of the lenticels. The first symptom of the disease is the withering of the leaves, which turn yellow ; this is followed by the death of the twig or branch. The affected organs are easily recognised by their knotty aspect, due to the agglomeration of black tumours disposed in a longitudinal direction and bearing first the conidia and afterwards the perithecia of the parasite.

The only method which can be advised for arresting the progress of the disease, is the removal of all affected branches.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

232 – **Observations on the Life-History of *Bupalus piniarius*.** — PLATNIKOFF, V., in *Lesnoi Journal* (Journal of Forestry), Year XLIV, No. 5, pp. 801-810. Petrograd, 1914.

The writer having set himself the task of studying the life-history of *Bupalus piniarius*, collected from beneath the snow, in November, 300 pupae which he believed to belong to this moth. From these the moths emerged in January, some proving to be *Macaria liturata*.

(1) See *B.* Feb. 1913, No. 185. (*Ed.*)

The moths lived about 15 days. The females deposited as many as 185 eggs. The larvae hatched out in 10 days, when the average temperature was 25° C. The number of moults was not definitely established, but 28 out of 30 caterpillars moulted three times and only 2 four times. At a uniform temperature of about 20-21° C. the life cycle of *B. piniarius* lasts about four months.

The females are distinguished from the males by their brown colour and rectilinear flight. The males are endowed with greater sensibility; they are the first to take flight, while the females allow themselves to be approached much nearer. Immediately after emerging, the moths feel the necessity of climbing upon some support in order to let their wings expand and dry. For this reason, those which emerge on a flat surface are often bumble-winged and incapable of flight, and numbers of them are to be seen collected on the ground where it has been raked over below the trees. This operation forms an excellent method of control; experiments made in this direction have given most successul results.

Pine needles are never wholly destroyed by these caterpillars; they are gnawed laterally, but the veins are untouched; these gradually turn brown and fall. In addition to pine, *B. piniarius* also attacks spruce, juniper, and more rarely the cones of the spruce.

Owing to its green colour, the caterpillar is well protected from enemies; but it has a considerable number: birds, larvae of Syrphids and Elaterids, and *Lydella nigriper*; the larvae of the latter live in the intestines of the *Bupalus* caterpillar.

233 - **The Economic Importance of Woodlice.** — COLLINGE, WALTER E., in *The Journal of the Board of Agriculture*, Vol. XXI, No. 3, pp. 206-213, 1 plate. London, June 1914.

From observations and information collected in the last few years, it appears that woodlice may become a source of very serious loss to horticulturists and others, unless they are systematically destroyed.

Life-history. — The eggs are laid early in the summer, and are retained by the female in a special pouch formed by a series of overlapping plates on the second and three succeeding segments of the thorax. Woodlice pass the whole larval period in the egg. The period of incubation varies in different species. In *Armadillidium vulgare* Linn., it lasts from 56 to 93 days; the number of young in a brood is in this case from 29 to 79; they undergo several moults. A brood of *Porcellio scaber* Latr. contains from 12 to 30 individuals; they also moult often, but their metamorphosis is more rapid than that of the former. In the case of *Porcellionides pruinosus* Brandt, reproduction and development are very rapid, much more so than in either *Armadillidium* or *Porcellio*; one pair produced four generations in 62 days.

Habits and habitat. — Woodlice are only found where moisture exists, and usually occur in dark and damp situations near dwellings, such as cellars, outhouses, about walls, cisterns, water barrels, under boards, stone and rubbish. They are generally plentiful in greenhouses and potting sheds. Rockeries are a favourite haunt. They also occur beneath the bark

of dead and decaying trees, and amongst decomposing vegetable matter or moss.

They usually feed during the night. In winter many species seek shelter in potting sheds, outhouses, cold frames, etc. ; *Armadillium vulgare*, on the other hand, remains at the roots of plants at a certain depth in the soil.

Economic importance. — Of the 35 species of *Oniscidae* found in the British Isles, the writer briefly describes the following as being the most common and the most important from an economic standpoint :

a) *Trichoniscus roseus* Koch., frequently the cause of considerable damage in greenhouses ; in one case it partially ruined a fernery, in another a number of choice ferns were almost entirely eaten away, while in a third case orchids were attacked.

b) *Oniscus asellus* Linn. — Numerous plants under glass are attacked by this species, which is a common pest in cold frames, potting sheds, flower-borders and vegetable gardens. It is frequently carried with the pots to the greenhouses, where it finds congenial surroundings. THEOBALD records this species as doing much harm in hot-houses and to soft wall-fruit ; it also eats strawberry roots ; the same observer reports it as devouring corks.

c) *Porcellio scaber* Latr. is very common in gardens ; it has been recorded as damaging the bark of lime-trees and is often very destructive in orchid houses and ferneries and seems to have a partiality for nearly ripe wall-fruits. This species, together with *P. dilatus* Brandt and *P. pictus* Brandt, has been recorded as doing damage in cold frames in the Channel Is. *P. scaber* also attacks potatoes and flower beds (a border of violas was destroyed by this species in early summer).

d) *P. pictus* Brandt, which is often found with the preceding species, is not so common nor so abundant.

e) *P. laevis* Latr. has been found damaging strawberry roots, and has been recorded as injuring cultivated mushrooms.

f) *Porcellionides pruinosus* Brandt is often found in greenhouses ; it has been recorded as damaging cotton, honeysuckle, various trees, lettuces under glass and also potatoes.

g) *Armadillidium vulgare* Linn. is recorded in the United States (where they are known as sow-bugs) as destructive to cotton, to numerous truck plants, date palms, cultivated mushrooms, rose-bushes and greenhouse plants. It has also been found on different trees and frequently causes serious injury to flower borders. It also attacks beans and potatoes ; beans are attacked also by the allied species *A. nosatum* Budde-Lund.

Preventive and remedial measures. — There is no doubt that neglect to clean out outhouses, potting sheds, etc., from time to time, has much to do with the increase of woodlice; again, rubbish heaps are frequently left to afford admirable breeding places.

PIERCE has found that sliced potatoes covered with a thin coating of Paris green or London purple are effective as baits for woodlice ; the latter

compound proved the best repellent. Kerosene emulsion as a contact spray was fatal. The writer has tried all the above and can confirm their efficacy.

It has also been found that in a greenhouse sprinkling Paris green on the floor and covering it with damp boards was very effective. Dusting the soil with equal parts of Paris green and ground unslaked lime is also an excellent remedy.

In gardens, the ground should be kept well broken up, free from clods, and well raked to prevent cracking; further, all accumulations of old boards and rubbish should be avoided.

The straw around manure heaps should be raked together and burnt before the heaps are opened for use. In this way many hundreds of woodlice may be collected and destroyed.

MEANS OF PREVENTION AND CONTROL

234 – ***Phanurus benificiens* and *Telenomus saccharalis* n. sp., Hymenoptera Parasitic in the Eggs of Insects Injurious to Sugarcane in Java.** — DODD, ALLAN P., in *Canadian Entomologist*, Vol. XLVI, No. 8, pp. 293-294. London, 1914.

The writer has found the following two Protoctrupid Hymenoptera in a small collection of the egg parasites of insects injurious to sugarcane in Java :

a) *Phanurus benificiens* Zehnter, reared from the eggs of *Diatraea striatalis* Sn. and of another undetermined moth on sugarcane leaves ; this insect had originally been described by Dr. ZEHNTER under the name of *Ceraphron benificiens*.

b) *Telenomus saccharalis*, bred from eggs found on sugarcane leaves and belonging probably to a Pentatomid (Hemiptera-Heteroptera).

235 – **The Destruction of the Scale Insect *Icerya purchasi* by Poisoning its Host-Plant *(Spartium junceum)*.** — SANFORD, FERNANDO, in *Science*, New Series, Vol. XI, No. 1032, pp. 519-520. Lancaster, Pa., and Garrison, N. Y., 1914.

A plant of Spanish broom (*Spartium junceum* L.) about twelve years old, of which the stem had a diameter of some 4 inches, was seriously attacked for many years by *Icerya purchasi* Mask. at Palo Alto (California). The writer tried spraying the broom with various substances; he placed upon it the natural insect enemies of *Icerya*, he cut off all the branches at once and sprayed the stem many times in the hope of permanently freeing the plant from scales, but up to last winter all his efforts appeared fruitless.

In February 1914, when the *Spartium junceum* was covered with scales, the writer made in its stem a hole about ½ in. in diameter and about 3 in. in depth which he almost completely filled with crystals of cyanide of potassium and then stopped up. In two days the scale insects began to fall from the plant and in a few more days all were dead. Others developed and attacked the plant, but these only remained a short time and the host plant was entirely freed from the parasites and again became very vigorous.

At the same time, the writer made a similar hole in an old peach tree which seemed worn out, introducing a similar amount of cyanide of potassium. The tree regained its normal vigour and yielded a good crop of fruit. After having given some of the latter to chickens and a rabbit, which ate them with impunity, Mr. SANFORD tried some of the peaches himself without

experiencing any bad results. Subsequently he introduced the same amoun of cyanide of potassium into an orange tree without observing any injurio u effects.

From these experiments, it appears certain that it is possible, at least in the case of certain plants, to poison parasitic scale insects, and in general those insects which feed on the sap, without harming the plant. This method seems especially suitable for the destruction of many species of borers and of insects which are harboured beneath the bark of their hosts.

236 – **The Influence of Cold Storage of Tropical Fruits upon the Eggs and Larvae of the Mediterranean Fruit-Fly (*Ceratitis capitata*).** — See above, No. 125.

INSECTS INJURIOUS TO VARIOUS CROPS

237 – **The Red Slug of Tea *(Heterusia cingala)* in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist : Journal of the Ceylon Agricultural Society*, Vol. XLIII. No. 2, pp. 128-129. Colombo, 1914.

Heterusia cingala (Lepidoptera, *Zygaenidae*), whose larva is known as the red slug of tea, is widely distributed in the tea gardens of Ceylon, where it periodically does much harm. The insect has been observed at Peradeniya and many other places. Eggs of a parasitic Tachinid are often found on the larvae.

238 – **Insects Injurious to Dadap *(Erythrina* sp.) in Ceylon.** — RUTHERFORD, A., in *The Tropical Agriculturist : Journal of the Ceylon Agricultural Society*, Vol. XLIII, No. 2, pp. 129-134. Colombo, 1914.

The writer enumerates the principal insects which are injurious to dadap (*Erythrina* sp.) in Ceylon.

The larvae of the following Lepidoptera defoliate the trees : 1) *Taragama dorsalis* Wlk., recorded in November 1913 as present on specimens of *Erythrina*; these having been pruned, the larvae destroyed the leaves of some hundreds of tea plants ; this insect has also been observed on *Albizzia* ; 2) *Eupterote geminata* Wlk., living equally on Gramineae, tea, cotton, *Hibiscus* and *Castilloa elastica;* 3) *E. fabia* Cram. (?) ; 4) *Orgyia postica* Wlk., which also lives in Ceylon on *Eucalyptus* sp., *Mucuna pruriens* var. *utilis*, tea and *Albizzia*.

These caterpillars can be controlled by spraying the leaves with lead arsenate.

The larvae of *Terastia meticulosalis* Guén., and those of another undetermined moth, bore into the twigs ; to destroy them the twigs must be cut off where the galleries begin and collected and burnt.

Lastly, the Pentatomid *Cyclopelta siccifolia* Westw. sucks the sap of the twigs, but as this insect lives in colonies, it is easily destroyed.

239 – **The Chrysanthemum Fly *(Phytomyza chrysanthemi)* in the United States.** — SMULYAN, M. T., in *Massachusetts Agricultural Experiment Station, Bulletin* No. 157, pp. 21-52, plates I-III. Amherst, Mass., 1914.

Phytomyza chrysanthemi Kowarz appears to be indigenous in America, where it is known as the chrysanthemum or marguerite leaf-miner or fly. It was recorded for the first time in the autumn of 1886, when it was found in a greenhouse near Glen Cove (New York). Since that date, the insect has been met with in many other localities. At present, its occurrence has

been recorded in the States of New Hampshire, Massachusetts, Connecticut, New York, Pennsylvania, Illinois, Wisconsin and Montana; it is no doubt to be found also in other States.

It seems that this insect attacks only *Compositae*; among the cultivated representatives of this family, *Chrysanthemum frutescens* and *C. parthenium* appear to be its favourite hosts. It also attacks species of *Eupatorium, Gazania, Helianthus, Cineraria, Tanacetum* and *Taraxacum*, as well as *Solidago nemoralis, Ambrosia artemisiifolia, Bidens frondosa, Daucus carota, Chrysanthemum leucathemum* (and other related species besides those given above) and *Antennaria plantaginifolia.* It is a special enemy of greenhouse plants.

The larvae mine in the leaves and feed on the mesophyll. On examining the surface of the leaves, it is seen that the mines appear in the shape of irregular whitish lines, or of irregular patches, often occupying the whole surface and causing the withering of part or the whole of the leaf. The destructive activity of the insect hinders the flowering of the plant, or reduces the normal number of the blossoms or their size. Young plants may be killed in a relatively short space of time if they remain continually exposed to the attacks of the flies. The injuries it causes are often very great; in many cases it has been necessary to give up the commercial cultivation of *Chrysanthemum frutescens* and other *Compositae.*

After having described the life cycle and habits of the insect, the writer draws attention to the fact that spiders living in greenhouses, especially *Salticus senicus* Clerk, serve greatly to reduce the number of the adult flies. No insect parasite of *P. chrysanthemi* appears to have been recorded.

The latter can also be controlled by means of spraying with liquids with a nicotine base, such as "black leaf 40", "Nico-Fume", "Nicoticide" (1 part of insecticide to 400-450 parts of water). The spraying should be effected every 11 or 12 days, or oftener if the temperature of the greenhouse is above that at which the plants (*e. g. C. frutescens*) are generally kept. The removal of the leaves attacked by the fly seems in the majority of cases to be of little use.

240 – ***Stenoptycha pinicolana* on Larches in the Valley of Aosta.** — SAVELLI, M., in *Cronaca Agricola*, Year XX, No 23, p. 177, 1 fig. Turin, 1914.

In July 1914, the larvae of the Tortricid *Steganoptycha pinicola* Zell. (= *S. diniana* Gr.) occurred in large numbers on the larches in the upper part of the valley of Aosta.

In Italy, these insects were recorded for the first time as causing severe damage to larch woods at Argentera and Bersezio (prov. of Cuneo), in 1901.

A detailed description of the larval, pupal and adult stages of this moth, based on abundant material received, is given.

241 – ***Ephestia elutella* (?), injuring Earthnut Cake in France.** — KEHRING, HENRI, in *Bulletin des Séances de la Société nationale d'Agriculture de France*, Vol. LXXIV, No. 9, pp. 864-866. Paris, 1914.

The writer states that the larvae of microlepidoptera cause damage to stored earthnut cakes by drilling galleries in them.

The commonest species seems to be *Ephestia elutella*, which the writer recently recorded as injuring cocoa stored in warehouses at Bordeaux. The female moth lays its eggs on the surface of the cakes and the larvae, on emerging, penetrate into the interior.

The longer the cakes are stored, naturally the more they are destroyed, for the larvae continue to increase in numbers. Thus, cakes which had been in the warehouse for 10 or 12 months became absolutely hollow and crumbled to pieces when handled; in such cases cases the loss was considerable.

The writer is of opinion that it would be possible to check the invasion of this insect by placing in the warehouses in spring receptacles (e. g. bowls, or simple earthen pots suspended near the cakes) containing a fermenting liquid consisting of molasses in water (10 per cent). As soon as the moths of the first brood emerge, after passing the winter as pupae in their cocoons adhering to the internal walls of the warehouse or to any kind of uneven surface, or even to the cakes themselves, it would be easy to catch the greater number of the moths destined to produce the generations which succeed one another until the autumn.

INJURIOUS VERTEBRATES.

242 – **The Muskrat *(Fiber zibethicus)* and its Ravages in Bohemia.** — HAEMPEL, O., in *Die Umschau*, Year XVIII, No. 48, pp. 970-973, 3 figs. Frankfort-on-Maine and Leipzig, 1914.

The writer reports that much destruction has already been wrought in Bohemia by an American rodent hitherto wholly unknown in Europe, *Fiber zibethicus* Cuv. (fam. *Arvicolidae*), popularly known as the muskrat or musquash. This animal has increased to an extrarodinary extent, and other parts of Austria and Central Europe are equally threatened.

Four pairs were imported eight years ago from Canada to Dobrisch (Bohemia). The animals were set at liberty and very soon became acclimatised; the conditions of life being most favourable, they increased so enormously that it is calculated that there are now more than two million individuals in Bohemia.

The muskrats spread in a radial direction; in 1907 they had already reached the neighbourhood of Przibram; in 1910-11 they were found in the immediate vicinity of Prague; in 1912-13 they reached Melnik, Raudnitz, Saatz, Wittingau and Frauenberg; recently, they have been reported from Moravia and Saxony.

In North America, *F. zibethicus* has a thick, glossy fur of a reddish-brown colour and much prized. For a short time the fur of the rodents acclimatised in Bohemia remained exactly similar to that of individuals living in America. Gradually however, the fur of the former deteriorated, becoming less thick and coarser, and at the same time losing its lustre, so that the tanners refuse the skin of the Bohemian muskrats.

While in America the muskrat generally pairs once a year (at the end of February or the beginning of March), and after a gestation period of about six weeks the female gives birth usually to from 3 to 6 young, it is estimated that in Bohemia this animal mates at least three times a year and litters of 9 or 10 young are by no means infrequent. It can thus be reckoned that a single pair produces annually about 40 individuals.

In its native country *F. zibethicus* subsists chiefly on a vegetable diet (aquatic plants, the produce of fields and orchards), and only exceptionally eats small fish or the eggsof fish, but in Bohemia it has during the last few years become more and more carnivorous.

The complaints as to the destruction caused by the muskrat in Bohemia increase every year. It tunnels in the steep banks of the fish-breeding ponds, thus, as has often been stated, causing the irremediable ruin of the most solid and oldest banks and exposing the country to the danger of inundation. Further, the railway embankments across lakes in Southern Bohemia are in danger of attack by this animal.

F. zibethicus destroys a large number of fish and their eggs; it readily eats crustaceans and molluscs and has recently been stated to attack and kill large game.

The agriculturist is also not spared; the omnivorous voracity of the muskrat causes it to ravage the crops; in its burrowing it pulls up the roots of many plants, thus causing the death of the latter; further, this animal also eats cereals, especially wheat, both before and after the harvest.

Seeing the large amount of damage *F. zibethicus* has done and the alarming rapidity of its increase, it is very desirable that the State should, without delay and by every means, organise the general and efficacious control of this rodent.

Erratum.

In *B.* Jan. 1915, p. 17, the table should read as follows:

For lighting purposes	119 148	1 948 439
For the manufacture of fulminate of mercury	—	3 291
» » » » collodion	—	871
» » » » sulphuric ether. . .	541	40 745
» » » » artificial silk . . .	—	267 927
» » » » various paints . . .	241	1 596
» » » » photographic films and plates. . . .	—	34
» » » » lysoform	—	811
Total . . .	119 930	2 263 714

Alfredo Ruggeri, *gerente responsabile.*

THE INTERNATIONAL MOVEMENT OF FERTILIZERS.

No. 2. *March, 1915.*

SUMMARY. — Introduction (p. 323). World's production of fertilizers (p. 325). – International trade in fertilizers (p. 335). – Consumption of fertilizers in different countries (p. 350). - Prices of fertilizers and chemical products for agricultural use (p. 358). Bibliography (p. 364).

INTRODUCTION.

The present number of the Review contains as far as possible final figures for the fertilizer production and trade in 1912 and 1913 together with provisional figures for 1914, according to the scheme outlined in the first number of the Review which was published in September 1914. Prices refer to the second half of 1914 and to forward deliveries for the beginning of 1915.

Production. — Two new tables have been added to the number appearing regularly, *i. e.* one referring to the world's production of natural guano and the other to the production of superphosphate in the different countries, while an estimate of the natural reserves of phosphates in the United States is also included in this particular number. The figures referring to natural guano are the result of a first attempt to collect statistics in this connection and show how widespread is the production of guano; those referring to superphosphate are worked up from the data of E. and M. Lambert (see INSTITUT INTERNATIONAL D'AGRICULTURE, *Production et consommation des engrais dans le monde*, 1914) and of Th. Waage (see Dungstoff-Erzeugung und -Verbrauch des Deutschen Reichs und der Welt, Der Saat-, Dünger- und Futtermarkt, XX, 1468-1469, 1914).

Owing to the present international situation it has been impossible to obtain figures relating to the production of potash salts in Germany. Figures, however, are available for this number of the Review giving the production and exports of nitrate of potash in India, while those relating to the nitrate of soda trade have been treated rather more fully in view of the present rather special market conditions; each half-year of 1914 is considered separately and an account is given of the general condition of the market at the end of 1914, as well as forecasts for European markets for the first three months of 1915.

Imports and Exports. — Other countries have been added to the list which send in returns of imports and exports; the new data come chiefly from colonies whose returns appear rather late and still only refer to 1912, but they are nevertheless useful in connection with the consumption of fertilizers in the colonies.

In other countries it has been possible to subdivide data appearing under a general heading and distribute them under the special headings.

Consumption. — Provisional figures are given for the consumption of fertilizers in the United States during the past season, and, following the plan adopted in the previous number of the Review, tables have been drawn up showing the actual consumption in Hungary, Norway, Netherlands and Portugal.

The world's consumption of sulphate of ammonia is given, together with exports from the United Kingdom.

Prices. — The plan adopted in the first number of the Review with regard to prices has been followed with the addition of a table giving prices for sulphate of copper which is to form a regular contribution to this section of the Review.

In order to show the condition of the market for nitrogenous fertilizers weekly prices for nitrate of soda at Liverpool and of sulphate of ammonia at Hull have been compared during the whole of 1914.

Data for certain markets failed completely from August onwards on account of the international situation.

Bibliography. — 178 references are herewith given; these are taken from journals and publications received at the Institute during the second half of 1914; the literature referred to chronicles the advances made in connection with fertilizers and their use, and supplements, not only the section dealing with the subject in the *Monthly Bulletin of Agricultural Intelligence*, but also the *Bulletin bibliographique hebdomadaire*, published by the Institute.

WORLD'S PRODUCTION OF FERTILIZERS AND OF CHEMICAL SUBSTANCES FOR AGRICULTURAL USE

Phosphatic Fertilizers.

I. — World's Production of Natural Phosphates.

Country	1912	1913	1914
	metric tons (1)	metric tons	metric tons
a) *Phosphorites:*			
United States of America	3 231 636	3 202 636	*a)* 1 750 000
			965 527
Tunis	2 057 498	2 284 678	*b)* 492 778
Algeria	377 601	438 601	*c)* 239 600
France	330 000	335 000	.....
Christmas Island	159 512	152 405	.....
Ocean and Nauru Islands	300 000	.....	.....
Belgium	203 100	(200 000)	.....
Egypt	69 958	64 138	.....
Angaur (Palau Islands)	60 000	90 000	*d)* 60 000
Makatea (Tuamotu Islands)	40 000	.....	.....
Dutch West Indies	20 362	.....	.....
Russia	25 000	25 000	.....
South Australia	6 198	6 049	.....
French Guiana	7 014	.....	.....
Spain	3 892	.....	.....
Japan	7 879	(8 000)	.....
Indochina	3	.....	.....
b) *Apatites.*			
Sweden	.....	.....	.....
Norway	.....	.....	.....
Canada	164	.....	.....
Total	6 899 817	(6 806 507)	.....

a) Estimated home consumption and exports Jan.-Nov. — *b)* Exports, first quarter. — *c)* Exports, first half-year. — *d)* Production first half-year.

The figures for the United States refer to amounts mined except in 1914; amounts sold were 3 146 573 m. tons in 1912 and 3 020 905 m. tons in 1913. The figures for Tunis also refer to amounts mined, while amounts despatched were 1 923 007 m. tons in 1912 and 1 984 880 m. tons in 1913.

(1) Metric ton = 0.9931 long ton. (*Ed.*).

The figures for Algeria on the other hand refer to exports and should be increased by the amount consumed internally for the manufacture of superphosphate, which is in part exported (see Part 2, table III, p. 337).

The Bureau of Soils, United States Department of Agriculture, have communicated the following estimate of the natural reserves of phosphates in that country which revises and corrects the provisional figures issued previously (see *Prod. et consom. des engrais chimiques*, p. 69).

II. — Reserves of Natural Phosphates in the United States.

Products	Phosphates stated in terms of high grade material (*i. e.* 75 per cent tricalcic phosphate)
Utah, Idaho, Wyoming and Montana:	
High grade	2 537 500 000
Other grades	7 612 500 000
Florida:	
All grades	359 614 500
Wash heap residues	20 300 000
Tennessee:	
All grades	116 801 125
South Carolina:	
All grades	10 150 000
Arkansas:	
All grades	20 300 000
Kentucky:	
All grades	507 500
Total	10 677 673 125

In the table III all figures obtained from direct sources and relating to the production of superphosphate in 1912 and 1913 have been collected. As these do not include data from all producing countries the totalling up of results to estimate the world's production has been postponed till such time as the necessary additional data be obtained.

III. — Production of Superphosphate in Different Countries.

Country.	1912	1913
	metric tons	metric tons
Germany	1 718 400	1 818 700
Austria-Hungary	250 000	265 000
Belgium	450 000	450 000
United States of America	3 248 000	3 248 000
Spain	210 000	225 000
France	1 950 000	1 920 000
Great Britain and Ireland	840 000	820 000
Italy	1 019 266	972 494
Netherlands	305 800	.....
Portugal	110 000	126 000
Sweden	168 478	.....

The figures relating to the production of superphosphate may also be used to estimate the consumption of superphosphate in the different countries except in the case of those countries which carry on a large export trade in that fertlizer.

IV. — World's Production of Basic Slag.

Country.	1912	1913
	metric tons	metric tons
Germany	2 110 000	(2 250 000)
France	679 000	(700 000)
Belgium	534 000	655 000
United Kingdom	400 000	404 000
Luxemburg	253 000	(250 000)
Austria-Hungary	92 000	(100 000)
Italy	20 000	20 000
Russia	16 000	32 000
Sweden	14 978	16 821
Other countries	(25 000)	(25 000)
Total	4 143 978	(4 452 821)

V. — World's Production of Natural Guano.

Countries	1912	1913	1914
	metric tons	metric tons	metric tons
Peru:			
Exports	38 633	37 530	.....
Internal consumption	33 672	36 807	.....
	72 305	74 337	.....
Seychelles	15 763	.....	.....
Chile	15 000	(15 000)	(15 000)
Madagascar and Dependencies	9 500	.....	.....
Union of South Africa	6 000	6 000	4 572
New Caledonia (phospho-guano from Huon and Chesterfield Islands)	3 830	2 100	.....
German South West Africa	1 498	.....	.....
Mexico	1 397	.....	.....
Dutch West Indies	1 061	.....	.....
Other countries	(10 000)	(10 000)	.....
Total	(136 354)	(107 437)	.....

Potassic Fertilizers.

The production of saltpetre in British India during 1912 was 14 797 metric tons ; exports during 1912 and 1913 were as follows :

VI. — Exports of saltpetre from British India.

Importing countries	1912	1913
	metric tons	metric tons
United Kingdom	1 931	2 867
Ceylon	1 851	2 226
China	4 510	4 093
Mauritius and Dependencies	1 751	1 941
United States of America	2 178	2 587
Other countries	790	1 766
Total	13 011	15 480

Nitrogenous Fertilizers.

VII. — General Movement of Chilean Nitrate.

Movement	1912	1913
	metric tons	metric tons
Production	2 586 975	2 773 459
Export	2 494 166	2 739 530
Consignments for consumption	2 530 645	2 556 973
Visible stocks (Dec. 31)	1 620 056	1 765 867

Owing to the exceptional state of the nitrate market caused by the European war each half-year of 1914 has been considered separately. Moreover a more detailed review of the present condition of the international market has been reproduced from *The Chemical Trade Journal and Chemical Engineer* (LXI, 69-70, January 25, 1915) as well as a forecast of the situation for the spring of 1915 published in Bradbury and Hirsch's *Review of the Market for Sulphate of Ammonia*, 1914.

VIII. — General Movement of Nitrate of Soda, January-June.

Movement	1912	1913	1914
	metric tons	metric tons	metric tons
Production in Chile	1 238 561	1 384 872	1 479 364
Shipments to Europe and Egypt	750 859	814 870	849 415
Shipments to United States of America and other countries	295 670	423 692	352 568
Deliveries in Europe	1 472 252	1 344 230	1 517 974
Germany	679 024	598 756	689 083
France	303 290	276 760	312 434
Belgium	240 803	226 274	241 718
Netherlands	94 594	91 241	110 648
United Kingdom	87 888	83 316	82 198
Deliveries in the United States:			
East coast	219 466	325 135	274 333
West coast	30 719	34 308	22 356
World deliveries	1 771 986	1 742 521	1 865 462
Stocks at the Chilean coast, end of June	629 949	617 757	776 260
Visible stocks in Europe, end of June	325 125	426 740	422 676
In European ports	94 492	120 910	138 182
On passage	230 643	305 830	284 493

IX. — General Movement of Nitrate of Soda, July to November.

Movement.	1912	1913	1914
	metric tons	metric tons	metric tons
Production in Chile:			
July	221 156	243 723	262 917
August	224 155	245 852	222 287
September	198 553	207 840	131 461
October	232 505	232 851	131 870
November	231 186	224 848	122 407
Total...	1 107 555	1 155 114	870 942
Exports, July 1-Nov. 30.			
Europe and Egypt:			
United Kingdom or Continent for orders	395 149	367 902	144 994
United Kingdom d. p.	21 570	23 266	20 285
Germany	278 560	285 479	34 183
Netherlands	57 659	52 457	14 925
Belgium	35 403	61 025	12 535
Denmark	.....	.....	10 058
France	76 470	60 308	18 577
Austria-Hungary	.....	.....	.....
Spain	5 766	6 794	.....
Italy	9 310	3 139	11 628
Sweden	.....	.....	15 994
Mediterranean	.....	13 311	.....
Egypt	23 792	12 304	23 468
	903 679	885 985	306 647
United States of America	195 152	201 647	186 930
Other countries	44 096	39 232	26 719
Total...	1 142 927	1 126 864	620 296
Visible stocks, October 31.			
Europe and Egypt (in port and afloat)	632 705	787 389	.....
United States (» »)	142 729	175 912	88 347
At Chilean coast	660 295	663 194	1 067 480
Total...	1 435 729	1 626 495	1 155 827

X. — General Condition of the Nitrate Market at the End of 1914.

	1913	1914	Difference
	metric tons	metric tons	metric tons
Production	2 783 440	2 471 351	— 312 089
Exports:			
Europe and Egypt	2 028 426	1 240 085	— 788 341
United States	633 404	541 787	— 91 617
Other countries	87 411	72 170	— 15 241
Total	2 749 241	1 854 042	— 895 199
Deliveries for consumption:			
Europe to July 31	1 444 423	1 607 163	+ 162 740
United States to Dec. 31	568 986	487 703	— 81 283
Other countries »	87 411	72 170	— 15 241
Stocks at Chilean coast, Dec. 31	507 769	1 109 219	+ 640 771
Stocks afloat » »	.....	39 321	

XI. — Condition of Nitrate Market in Europe and Egypt, End of 1914 - April 1915.

	1914	1915
	metric tons	metric tons
Stocks in Europe excluding Germany, Austria-Hungary and Belgium, end of June	81 284	.....
Stocks afloat, end of June	264 172	.....
» » » for July delivery in Germany, Austria-Hungary and Belgium; to be deducted	50 802	.....
	294 654	.....
Shipments, July-Dec.	390 162	.....
	684 816	684 816
Shipments, Jan.-end of April	.....	101 605
		786 421
Consumption in Europe excluding Germany, Austria-Hungary and Belgium, July-Dec.; to be deducted	172 728	172 728
Idem, Jan.-April; *idem*	.....	406 419
		207 274
Amounts lost at sea, sheltered in neutral ports and seized as contraband; to be deducted	.....	75 187
Amounts available, end of April	.....	132 087

XII. — World's Production of Sulphate of Ammonia.

Country	1912	1913	1914
	metric tons	metric tons	metric tons
Germany	492 000	549 000	(500 000)
United Kingdom	394 226	438 932	427 756
United States	149 700	176 900	166 014
France	69 100	75 400	
Belgium	43 700	48 600	
Austria-Hungary	35 500	39 000	
Italy	11 100	15 000	
Spain	12 000	15 000	
Netherlands	6 000	6 000	(200 000)
Russia	4 000	8 000	
Japan	7 300	8 000	
Australia	3 000	3 000	
Denmark	2 400	2 800	
Sweden	1 400	1 400	
Other countries	(25 000)	(25 000)	
Total	1 256 426	1 412 032	(1 293 770)

The figures for the United Kingdom refer to the total amount of ammonia produced stated as sulphate; according to the Board of Trade the sulphate of ammonia actually produced would only be a little over 84.34 per cent of these figures. The amount of ammonia produced in Italy in the first half-year of 1914 refers only to sulphate formed by the conversion of calcium cyanamide.

During the second half of 1914, the production of sulphate of ammonia decreased owing to the fact that a certain number of coke ovens ceased working. But there is every reason to believe that in the course of 1915 the production will not only become normal again but even increase considerably, as over and above coke ovens as a source of the fertilizer the substance will be produced synthetically and also from peat.

In Italy as much as 5 500 m. tons of sulphate of ammonia was produced from calcium cyanamide at Collestatte (Terni) in 1914, while at Codigoro and Orentano it has been estimated that over 6 000 m. tons were produced from peat by the Mond-Frank-Caro process.

XIII. — World's Production of Calcium Cyanamide.

Country.	1912	1913	1914
	metric tons	metric tons	metric tons
Germany	22 000	24 000	(36 000)
Austria-Hungary	5 000	(7 500)	(24 000)
United States	(14 000)	31 000	(64 000)
France	(7 500)	(7 500)	(7 500)
Italy	10 304	14 982	22 500
Japan	5 199	(7 500)	(7 500)
Norway	13 892	22 111	(23 500)
Sweden	6 043	17 000	(17 000)
Switzerland	(7 500)	(7 500)	(7 500)
Total	(91 438)	(139 093)	(209 500)

Figures in brackets represent the productive capacity of the factories : the others represent the actual production.

XIV. — Movement of Norwegian Nitrate of Lime.

	1912	1913	1914
	metric tons	metric tons	metric tons
Estimated production	.....	70 000	*a)* 35 000
Exports	51 701	70 171	*b)* 65 322
Consumption in Norway	5 000	(5 000)	(5 000)

(*a*) First half year. — (*b*) Jan.-Oct.

While the production and consequently the use of calcium cyanamide developed considerably in the United States in 1914, a diminution will certainly be recorded during the current year owing to the state of the cotton market. On the other hand new cyanide works are projected for Germany during 1915, on such a scale, that if they are carried through the increased production of cyanamide will compensate for the lack of imports of sodium nitrate in that country.

Other Chemical Products for Agricultural Use.

XV. — World's Production of Crude Sulphur.

Country	1912	1913	1914
	metric tons	metric tons	metric tons
Sicily	356 531	345 349	334 978
	10 000	10 000	(10 000)
Other Italian regions	37 497	38 722	(37 000)
Italy (total)	404 028	394 071	381 978
United States	308 328	316 575	381 018
Japan	54 256	49 131	(50 000)
Other countries	(50 000)	(50 000)	(50 000)
Total	816 612	809 777	862 996

According to information from the " Consorzio solfifero siciliano " the production in Sicily is made up of the amounts conveyed to exporting ports together with the internal consumption, which is estimated as 10 000 metric tons.

XVI. — World's Production of Sulphate of Copper.

Country	1912	1913	1914
	metric tons	metric tons	metric tons
United Kingdom	85 500	76 843	68 973
Italy	52 312	44 970	.....
United States	17 908	24 643	.....
France	26 000	26 000	.....
Austria-Hungary	15 200	15 400	.....
Germany	5 942	5 682	.....
Other countries (Sweden, Peru, etc.)	1 000	1 000	.....
Total	203 862	194 538	.....

INTERNATIONAL TRADE IN FERTILIZERS AND CHEMICAL PRODUCTS FOR AGRICULTURAL USE.

The same plan has been followed as in the first number of the Review. The fiscal year in New Zealand and Ceylon ending on March 31, the figures for the year ending in March 1913 and 1914 are given under 1912 and 1913 respectively.

Phosphatic Manures.

I. — Import and Export of Natural Phoshates.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	902 824	928 798	*a)* 420 165	7 032	6 885	*a)* 732
German New Guinea { Nauru	.....	.....	.....	138 725	.....	.....
German New Guinea { Palau	.....	.....	.....	54 000	.....	.....
Austria-Hungary	175 831	212 003	*a)* 128 180	.....	.....	.....
Belgium	244 221	244 765	*a)* 113 668	22 916	18 158	*a)* 10 988
Denmark	45 710	55 875	*a)* 31 077	.....	.....	.....
Egypt	.....	.....	.....	52 115	64 183	.....
Spain	176 183	254 463	*b)* 163 921	.....	.....	.....
United States	.....	.....	.....	1 225 824	1 388 362	*c)* 965 527
France	907 845	934 679	*b)* 647 769	22 062	21 128	*b)* 9 814
Algeria	.....	.....	.....	377 601	438 601	*a)* 239 690
French Establishments in Oceania	.....	.....	.....	38 488	.....	.....
French Guiana	.....	.....	.....	7 014	.....	.....
Indo-China	.....	.....	.....	27	.....	.....
Tunis	.....	.....	.....	1 910 198	.....	*d)* 492 778
Great Britain / Ireland	528 591	547 640	564 521	4 492	11 808	2 646
Australia	99 757	162 599	.....	.....	943	.....
Canada .....fr.	125 090	84 065	*e)* 85 972	.....	190	.....
Union of South Africa	.....	691	.....	.....	.....	.....
Straits Settlements	.....	.....	.....	159 467	.....	.....
Italy	466 144	529 776	513 998	1 285	4 171	8 569
Japan	286 984	333 916	*b)* 274 530	.....	.....	.....
Netherlands	60 161	84 048	.....	5 708	1 650	.....
Russia	47 438	53 580	*b)* 20 328	.....	.....	.....
Sweden	81 574	123 250	*f)* 65 503	.....	.....	.....
Switzerland	17 821	18 885	*a)* 9 130	.....	.....	.....

a) First half-year. — *b)* Jan.-Oct. — *c)* Jan.-Nov. — *d)* First quarter. — *e)* April-Oct. — *f)* Jan.-Sep.

II. — Imports and Exports of Basic Slag.

Country	Imports			Exports.		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	372 835	441 069	a) 234 081	663 024	713 878	a) 307 106
Austria-Hungary	203 536	212 788	a) 110 153	3 607	2 007	a) 950
Belgium	130 439	144 553	a) 76 248	550 841	685 907	a) 335 016
Denmark	9 948	8 957	a) 7 123	.....	.....	.....
France	59 870	41 010	b) 29 204	248 840	246 271	b) 234 749
Great Britain Ireland	50 102	51 951	16 838	159 689	167 742	134 808
Canada fr.	478 993	330 417	c) 59 360	.....	.....	.....
New Zealand	20 456	30 837	.....	.....	.....	.....
Union of South Africa	.....	5 416	.....	.....	.....	.....
Italy	118 190	119 257	23 224	14	103	.....
Japan	245	17	.....	.....	.....	.....
Norway	40 257	34 492	b) 33 809	.....	.....	.....
Netherlands	339 968	438 113	.....	154 483	197 854	.....
Portugal	.....	70 000	.....	.....	.....	.....
Russia	170 340	186 410	b) 116 529	.....	.....	.....
Sweden	21 049	19 243	d) 13 629	.....	.....	.....
Switzerland	54 182	55 793	a) 14 319	.....	.....	.....

a) First half-year. — *b*) Jan.-Oct. — *c*) April-Oct. — *d*) Jan.-Sep.

In 1912 and 1913 the figures for France are those given under the heading of " machefer " in the returns ; when ground, the same material was entered under the heading " engrais chimique " till the end of 1913 so that the figures for 1912 and 1913 only refer to a portion of the trade in slag. In 1914 the new returns for slag are added to those of " machefer ". In Spain basic slag is returned under the same heading as superphosphate ; the figures are given in table III.

III. — Imports and Exports of Superphosphate.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	62 399	53 193 a)	29 225	271 349	282 653 a)	192 145
Austria-Hungary	79 531	75 224 a)	43 993	5 354	3 748 a)	1 971
Belgium	37 802	28 012 a)	31 435	314 713	318 922 a)	171 390
Denmark	102 135	110 155 a)	125 713	.....	.....	.....
Egypt	11 459	13 148	.....	.....	.....	.....
Spain	161 047	149 602 b)	97 571	.....	.....	.....
France	89 059	100 822 b)	57 690	169 617	145 236 b)	101 297
Guadeloupe and Dep.	12 198	.....	.....	.....	.....	.....
Martinique	3 105	.....	.....	.....	.....	.....
Tunis	.....	..... c)	770	.....	.....	.....
Algeria	28 183	18 164 a)	1 284	3 329	8 006 a)	3
Great-Britain	.....	.....	.....	90 314	64 496	67 111
Ireland						
Australia	49 150	27 138	.....	9 265	11 855	.....
Canada	878	966 d)	530	.....	.....	.....
New Zealand	33 493	42 249	.....	.....	.....	.....
Union of South Africa	.....	37 207	.....	.....	.....	.....
Japan	254	977	.....	25 705	16 885	.....
Mexico	.....	60	.....	.....	.....	.....
Norway	8 543	4 283 b)	9 133	.....	.....	.....
Netherlands	295 613	270 378	.....	346 186	352 849	.....
Portugal	.....	20 000	.....	.....	.....	.....
Russia	188 244	196 870 b)	118 325	.....	.....	.....
Sweden	9 815	3 260	.....	57 807	36 037 e)	36 888

a) First half-year. — b) Jan.-Oct. — c) First quarter. — d) April-Oct. — e) Jan.-Sep.

In many countries, such as Italy and certain colonies, where the use of fertilizers is still very limited, superphosphate is included under the general heading of "chemical fertilizers" in the returns and therefore does not appear in the above table.

The figures for Spain include basic slag.

IV. — Imports and Exports of Natural and Artificial Guano.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	28 659	35 299 a)	14 283	844	136 a)	182
	18 509	26 620 a)	4 886	6 140	5 691 a)	3 138
Argentine Republic	.....	.....	.....	24 078	28 630 b)	12 427
Belgium	15 166	49 541 a)	11 099	31 697	29 446 a)	14 979
Chile	509	.....	.....	.....	.....	.....
Spain	2 486	1 781 c)	2 382	.....	.....	.....
United States	19 467	19 411 d)	22 945	.....	.....	.....
France	311	1 376 c)	2 492	408	317 c)	224
Algeria	2 512	.....	.....	.....	.....	.....
Guadaloupe and Dep.	662	.....	.....	.....	.....	.....
Madagascar and Dep.	.....	.....	.....	9 500	.....	.....
Martinique	2 245	.....	.....	.....	.....	.....
New Caled. and Dep.	.....	.....	.....	3 830	.....	.....
French Somali Coast.	64	.....	.....	62	.....	.....
Great Britain Ireland	14 341	25 957	39 915	.....	.....	.....
Australia	27 528	1 362	.....	25	317	.....
Canada	1 896	3 289 e)	1 325	.....	.....	.....
British India	93	74	.....	21 752	16 545	.....
New Zealand	25 435	22 448	.....	.....	.....	.....
Union of South Africa	.....	318	.....	.....	.....	.....
Ceylon	3 720	.....	.....	.....	.....	.....
Seychelles	.....	.....	.....	15 763	.....	.....
Falkland. .... francs	.....	.....	.....	76 421	603 288	.....
Newfoundland	.....	.....	.....	479	.....	.....
Italy	195	111	146	.....	.....	.....
Japan	5 171	3 093 c)	2 102	.....	.....	.....
Norway	.....	.....	.....	10 693	13 063 c)	9 199
Netherlands	13 890	22 317	.....	11 046	10 968	.....
Russia	1 310	64	102	.....	.....	.....
Sweden	187	640	.....	454	664	.....
Switzerland	112	72 a)	73	.....	.....	.....

a) First half-year. — b) Jan.-Aug. — c) Jan.-Oct. — d) Jan.-Nov. — e) April-Oct.

V. — Imports and Exports of Bones and Bone Manures.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	16 343	24 481	a) 13 731	7 870	651	a) 3 219
	36 842	30 845	a) 11 035	28 925	32 474	a) 19 335
Argentine Republic	.....	.....	.....	30 451	30 716	b) 16 961
	.....	.....	.....	1 427	895	.....
Austria-Hungary	13 336	7 080	a) 4 138	10 193	9 582	a) 1 957
Belgium	41 656	45 509	a) 21 110	16 365	22 748	a) 18 844
Brasil	.....	.....	.....	.....	.....	a) 1 653
						a) 2 730
Chile	.....	.....	.....	1 730	.....	.....
	.....	.....	.....	38	.....	.....
China	.....	.....	.....	29 976	33 682	.....
Denmark	120	.....	a) 143	34	.....	.....
Turkey	28	.....	.....	4 794	.....	.....
Egypt	.....	.....	.....	4 310	3 747	.....
Spain	.....	.....	.....	2 241	2 651	c) 1 729
United States	34 703	35 173	d) 35 961	.....	.....	.....
France	38 095	36 768	c) 32 110	10 962	13 486	c) 11 842
	892	2 627	c) 382	977	499	c) 520
Algeria	.....	.....	.....	1 656	1 774	a) 1 122
Indo-China	.....	.....	.....	1 166	.....	.....
Madagascar and Dep.	.....	.....	.....	105	.....	.....
				27	.....	.....
Tunis	.....	.....	.....	862	.....	.....
Great Britain and Ireland	41 862	41 336	34 959	.....	.....	.....
Australia	445	779	.....	6 378	4 384	.....
Canada	1 204	2 207	e) 536	9	3 311	e) 2 266
	3 839	3 890	e) 2 935	.....	.....	.....
British India	52	243	.....	111 990	107 105	e) 42 256
New Zealand	10 100	7 358	.....	.....	.....	.....
Union of South Africa	.....	4 276	.....	.....	.....	.....
Ceylon	6 750	.....	.....	.....	.....	.....
Greece	.....	.....	.....	300	255	.....
Italy	4 193	5 630	2 953	3 630	7 028	4 585
Japan	39 302	47 894	c) 16 428	.....	.....	.....
Norway	.....	.....	c) 745	863	1 217	.....
Netherlands	3 879	7 045	.....	8 090	12 033	.....
Russia	668	2 527	c) 277	6 454	7 273	c) 2 768
				36 774	32 450	c) 25 586
Servia	78	.....	.....	478	459	277
Sweden	4 475	.....	.....	283	.....	.....
Switzerland	.....	.....	.....	733	1 500	615
Uruguay	.....	.....	.....	4 527	7 045	.....
	.....	.....	.....	5 755		

a) Firet half-year. — b) Jan.-Aug. — c) Jan.-Oct. — d) Jan.-Nov. — e) April-Oct.

Where two sets of figures are given for any country, the first set refer to raw bones and the second to treated bones, such as bone flour, bone ash, calcined bones.

Potassic Fertilizers.

VI. — Imports and Exports of Potash Salts.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	.....	..... a)	.....	1 300 459	1 676 156 a)	727 042
	44	44 a)	52	133 358	133 358 a)	50 061
	46	15 a)	30	393 320	393 320 a)	159 348
Austria-Hungary	97 721	110 069 a)	54 330	1 572	1 774 a)	1 155
	13	19 a)	6	800	1 474 a)	845
	5 280	5 216 a)	1 889	855	1 317 a)	697
Chile	49	.....	.....	.....	.....	.....
Denmark	25 887	24 667 a)	6 941	.....	.....	.....
Egypt	144	.....	.....	.....	.....	.....
	694 133	600 168 b)	500 465	.....	.....	.....
United States	44 071	40 172 b)	34 607	.....	.....	.....
	218 751	217 191 b)	162 970	.....	.....	.....
France	17 805	11 284 c)	11 582	620	708 c)	521
	45 174	46 137 c)	30 317	271	134 c)	79
Guadeloupe and Dep.	328	.....	.....	.....	.....	.....
	1	.....	.....	.....	.....	.....
Martinique	1 210	.....	.....	.....	.....	.....
	1	.....	.....	.....	.....	.....
Tunis	35	.....	.....	.....	.....	.....
	27	.....	.....	.....	.....	.....
United Kingdom . frs.	15 615 098	15 895 384	12 136 790	2 366 020	3 302 995	2 901 924
	19 313	17 781	.....	.....	.....	.....
Ireland	442	414	.....	.....	.....	.....
	1 204	1 173	.....	.....	.....	.....
Canada	19	180 e)	66	.....	.....	.....
	4 781	6 957 e)	2 910	.....	.....	.....
New Zealand	9 860	4 619	.....	.....	.....	.....
Union of South Africa	.....	1 812	.....	.....	.....	.....
	14 112	.....	.....	.....	.....	.....
Ceylon	123 784	.....	.....	.....	.....	.....
	27 304	.....	.....	.....	.....	.....
Mauritius	3 379	258 a)	55	.....	.....	.....
Greece	276	67	.....	.....	.....	.....
Italy	13 466	9 454	3 708	1	2	166
	8 153	7 061	6 290	.....	6 290	128
Japan	81	.....	.....	.....	.....	.....
Mexico	.....	10 a)	50	.....	.....	.....
	.....	81	.....	.....	.....	.....
Norway	21 304	21 084	19 255	.....	.....	.....
Netherlands	154 656	214 065	.....	2 688	44 021	.....
	75 236	105 193	.....	.....	7 069	.....
Dutch Indies	15	.....	.....	.....	.....	.....
	3 075	2 186 a)	1 500	.....	.....	.....
Portugal	262	539 a)	250	.....	.....	.....
	1 237	1 400 a)	600	.....	.....	.....
Russia	83 082	76 972 c)	51 566	.....	.....	.....
	6 044	3 407 c)	4 111	.....	.....	.....
Sweden	85 776	80 253 d)	54 374	.....	.....	.....
Switzerland	15 006	13 241 a)	8 253	.....	.....	.....
	1 572	1 572 a)	802	.....	.....	.....

a) First half-year. — b) Jan.-Nov. — c) Jan.-Oct. — d) Jan.-Sep. — e) April.-Oct.

Where there are more than one set of figures for one country, the first refers to substances designated as «potash manure salts», the second to substances designated as «sulphate of potash», and the third to substances designated as «muriate of potash», except in the case of France and her colonies, Italy and Mexico when the first figures refer to sulphate and the second to muriate of potash, and in the case of Holland where the second set of figures refers to various concentrated salts.

VII. — Imports and Exports of Other Potash Manures

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	597	402	*a)* 276	14 450	16 058	*a)* 7 551
Chile	86	.....	.....	.....	.....	.....
China	3 886	3 623	.....	.....	.....	.....
United States	3 318	4 480	*b)* 1 011	.....	.....	.....
France	53	71	*c)* 291	952	709	*c)* 484
	1 293	3 597	*c)* 1 445	3 719	1 586	*c)* 1 559
Guadeloupe and Dep.	186	.....	.....	.....	.....	.....
Indo China	77	.....	.....	.....	.....	.....
Madagascar and Dep.	3	.....	.....	.....	.....	.....
Martinique	289	.....	.....	.....	.....	.....
Great Britain and Ireland	11 034	12 085	10 659	1 936	1 723	1 042
Canada (barrels)	840	938	*d)* 500	.....	.....	.....
	.....	.....	.....	55	43	*d)* 309
British India	3	27	.....	15 076	13 618	*d)* 6 585
Ceylon	2 115	.....	.....	.....	.....	.....
Mauritius and Dep.	2 147	2 083	*a)* 918	.....	.....	.....
Greece	2 576	2 684	.....	.....	.....	.....
Italy	461	458	249	3	6	7
Japan	.....	10	*c)* 452	.....	.....	.....
Norway	418	522	*c)* 136	.....	.....	.....
	.....	.....	.....	1 784	2 521	*c)* 1 815
	.....	.....	.....	32 844	32 796	*c)* 18 623
	.....	.....	.....	7 000	53 047	*c)* 6 492
Netherlands	4 312	6 721	*b)* 5 931	7 407	6 243	*b)* 5 922
Servia	352	.....	.....	.....	.....	.....
Sweden	.....	.....	.....	34 643	37 655	*e)* 15 252

a) First half-year. — *b)* Jan.-Nov. — *c)* Jan.-Oct. — *d)* April-Oct. — *e)* Jan.-Sep.

The product referred to in this table is nitrate of potash except in the following cases:

1. The second set of figures for France, which refer to beet potash.
2. The second set of figures for Canada which refer to wood ashes,
3. „ „ „ „ „ Norway „ „ kelp ash,
4. The third „ „ „ „ „ „ felspar,
5. The fourth „ „ „ „ „ „ ground felspar
6. The single „ „ „ Sweden „ „ felspar,

Nitrogenous Manures.

VIII. — Imports and Exports of Nitrate of Soda.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	812 898	774 298 a)	589 854	27 431	27 557 a)	23 324
Argentine Republic	373	649	.....	.....	.....	.....
Austria-Hungary	9 283	93 025 a)	62 733	403	313 a)	580
Belgium	235 382	304 136 a)	164 598	122 668	13 999 a)	88 195
Brazil	.....	..... a)	12 071	.....	.....	.....
Chile	.....	.....	.....	2 498 529	2 738 339	.....
Costa-Rica	.....	4	.....	.....	.....	.....
Denmark	36 402	35 024 a)	41 877	.....	.....	.....
Equator	.....	..... a)	3	.....	.....	.....
Egypt	56 047	56 474	.....	.....	.....	.....
Spain	46 715	35 557 b)	35 268	.....	.....	.....
United States	444 134	635 876 c)	519 325	.....	.....	.....
France	353 776	322 115 b)	282 526	10 233	5 268 b)	2 024
Indo-China	33	.....	.....	.....	.....	.....
Madagascar and Dep.	1	.....	.....	.....	.....	.....
Martinique	1 844	.....	.....	.....	.....	.....
Tunis	10	.....	.....	.....	.....	.....
United Kingdom	125 557	143 181	174 669	.....	.....	.....
Australia	3 224	3 393	.....	281	516	.....
Canada	39 714	36 406 d)	7 340	.....	.....	.....
Union of South Africa	.....	66	.....	.....	.....	.....
Ceylon	278	.....	.....	.....	.....	.....
Mauritius	373	539 a)	10	.....	.....	.....
Italy	54 634	67 418	59 850	27	50	179
Japan	85 271	112 405 b)	24 317	.....	.....	.....
Norway	1 130	1 337 b)	780	184	811 b)	716
Netherlands	204 169	202 928 c)	149 160	129 763	121 096 c)	111 548
Portugal	.....	1 500	.....	.....	.....	.....
Russia	51 615	43 359 b)	48 634	.....	.....	.....
Servia	135	.....	.....	.....	.....	.....
Sweden	35 107	33 892 e)	33 835	.....	.....	.....
Switzerland	3 162	3 328 a)	1 896	37	29 a)	291

a) First half-year. — b) Jan.-Oct. — c) Jan.-Oct. — d) April-Oct. — e) Jan.-Sep.

IX. — Imports and Exports of Sulphate of Ammonia.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	23 098	34 627	a) 22 528	57 267	75 868	a) 74 723
Austria-Hungary	21	56	a) 28	20 818	23 816	a) 20 210
Belgium	20 062	24 199	a) 22 976	17 886	41 382	a) 17 239
Denmark	24	221	a) 645	2 415	2 329	a) 983
Egypt	651	1 650	.....	.....	.....	.....
United States	54 015	59 670	b) 69 612	.....	.....	.....
France	22 892	22 995	c) 8 783	1 976	1 151	c) 981
Martinique	1 281	.....	.....	.....	.....	.....
Great Britain Ireland	.....	.....	.....	289 512	328 223	318 914
Australia	4	792	.....	3 718	2 340	.....
Canada	219	159	d) 158	.....	.....	.....
Union of South Africa	.....	362	.....	.....	.....	.....
Barbadoes	3 296	.....	.....	.....	.....	.....
Ceylon	2 466	.....	.....	.....	.....	.....
Mauritius	6 164	5 319	a) 1 468	.....	.....	.....
Italy	21 190	21 669	13 110	4	55	8
Japan	93 416	26 938	c) 44 952	.....	.....	.....
Mexico	.....	63	a) 19	.....	.....	.....
Norway	.....	.....	.....	175	138	c) 188
Netherlands	39 275	31 177	.....	31 317	18 702	.....
Dutch Indies fr.	21 086 150	18 915 456	.....	.....	.....	.....
Portugal	.....	2 500	.....	.....	.....	.....
Servia	76	136	a) 52	.....	.....	.....
Sweden	46	38	.....	41	254	.....

a) First half-year. — *b*) Jan.-Nov. — *c*) Jan.-Oct. — *d*) April-Oct.

For details of exports from Great Britain see page 370. It is practically certain that a considerable amount of sulphate of ammonia is exported from Southern Russia, but this fact does not appear from the official statistics. The tendency to increase exports from Germany and Austria-Hungary should be noted.

X. — Imports and Exports of Synthetic Nitrogenous Fertilizers.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	44 612	54 378	a) 31 038	8 134	30 466	a) 22 440
Denmark	412	5 066	a) 5 675	.....	.....	.....
Egypt	728	971	.....	.....	.....	.....
United States	2 339	.....	.....	.....	.....	.....
France	3 160	10 010	b) 3 809	789	839	b) 330
Algeria	766	1 091	a) 458	.....	.....	.....
Canada	737	1 167	c) 672	.....	.....	.....
New Zealand	148	136	.....	.....	.....	.....
Mauritius	437	282	100	.....	.....	.....
Mexico	.....	.....	2	.....	.....	.....
Norway	.....	.....	.....	4 270	7 807	b) 9 518
	.....	.....	.....	51 701	70 171	b) 65 222
	.....	.....	.....	13 892	22 112	b) 13 081
Portugal	.....	2 000	.....	2 000	.....	.....
Russia	2 243	2 326	b) 1 360	.....	.....	.....
Sweden	8	.....	.....	.....	.....	.....
	176	24	.....	.....	.....	.....
	.....	62	.....	4 058	16 930	.....

a) First half-year. — *b*) Jan.-Oct. — *c*) April.-Oct.

The first, second and third sets of figures for Norway and Sweden refer to nitrate of ammonia, nitrate of lime and calcium cyanamide respectively. Exports of nitrate of lime from Norway continue to increase as do those of calcium cyanamide from Sweden and those of both manures from Germany; since the outbreak of the European war, Germany has ceased to export these fertilizers, and has imported chiefly nitrate of lime from Norway.

In many returns synthetic nitrogenous fertilizers are not given under a separate heading and therefore cannot be included in table X; such is the case in Italy from whence an appreciable amount of calcium cyanamide is exported. Imports of synthetic nitrogenous fertilizers occur in Russia and Denmark and in smaller quantities in New Zealand, calcium cyanamide is imported into Portugal and nitrate of lime into the United States and Mauritius.

XI. — Exports and Imports of Organic Nitrogenous Fertilizers.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	3 261	2 899 *a)*	1 373	5 307	6 704 *a)*	3 941
	57 930	64 421 *a)*	35 636	12 022	15 781 *a)*	9 866
Argentine Republic	.....	.....	.....	13 858	12 782 *b)*	3 619
Austria-Hungary	893	560 *a)*	217	3 647	3 444 *a)*	1 589
	1 237	1 667 *a)*	963	777	654 *a)*	388
Brazil	80	.....	.....	60	..... *a)*	85
China	161	19	.....	51 066	79 372	.....
	.....	.....	.....	493 477	1 066 551	.....
Egypt	.....	.....	.....	.....	75	.....
	.....	.....	.....	80 778	62 977	79 987
Spain	.....	.....	.....	14 143	24 869 *c)*	20 053
France	72 573	82 072 *c)*	39 679	31 365	30 728 *c)*	17 227
Indo-China	100	.....	.....	37	.....	.....
	1 068	.....	.....	590	.....	.....
Martinique	104	.....	.....	.....	.....	.....
	86	.....	.....	.....	.....	.....
Tunis	762	.....	.....	113	.....	.....
British India	19	464 *d)*	371	164 380	178 126 *d)*	84 082
New Zealand	1 581	1 783	.....	.....	.....	.....
Ceylon	42 901	.....	.....	.....	.....	.....
Straits Settlements	2 380	.....	.....	6 196	.....	.....
	190	.....	.....	.....	.....	.....
Mauritius	1 502	1 416	276	.....	.....	.....
Japan	5 656	4 820 *c)*	1 491	.....	.....	.....
	607 778	859 008 *c)*	655 560	.....	.....	.....
Netherlands	22 628	23 982	.....	10 215	10 574	.....
Switzerland	145	136	.....	652	1 626	.....
	2 190	2 053 *a)*	473	1 354	1 579 *a)*	794
Uruguay	.....	.....	.....	137 559	.....	.....

a) First half-year. — *b)* Jan.-Aug. — *c)* Jan.-Oct. — *d)* April-Oct.

The first set of figures for Germany, Austria-Hungary and Switzerland refer exclusively to horns and hoofs for manurial use; the second set refer to other animal residues, blood, etc. The figures for the Argentine Republic and Uruguay represent the total slaughterhouse residues excluding meat guanos and bones, which are given elsewhere.

The exports and imports for China, Egypt and India consist entirely of oil cakes with the exception of a small export of other material from Egypt shown in the first figure for 1913. Soya bean exports from China are classified separately in the second set of figures for 1912. It should be noted that oil cakes are largely but by no means exclusively, used for manure in India.

Other Fertilizers and Chemical Products used in Agriculture.

XII. — Imports and Exports of Unenumerated Chemical Fertilizers.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
German East Africa	100	.....	.....	.....	.....	.....
Kamerun	1 448	.....	.....	.....	.....	.....
Togo	39	.....	.....	.....	.....	.....
German S. W. Africa	30	.....	.....	.....	.....	.....
Argentine Republic	381	546	.....	.....	.....	.....
Brazil	6 062	*a)* 2 930	*a)* 2 291	.....	.....	.....
Chile	52	.....	.....	.....	.....	.....
China	49 647	54 938	.....	.....	.....	.....
Cuba	25 384	21 701	.....	.....	.....	.....
Egypt	61	245	72 612	.....	.....	.....
Spain	90 684	91 380	*b)* 77 940	.....	.....	.....
United States frs.	18 285 699	25 890 163	*c)* 23 052 035	m.t. 75 780	73 911	*c)* 58 540
France	147 495	223 217	*b)* 71 745	306 975	403 305	*b)* 8 960
Algeria	9 493	10 299	*a)* 4 298	.....	.....	.....
Guadeloupe and Dep.	1 490	.....	.....	.....	.....	.....
French Guinea	1	.....	.....	.....	.....	.....
Indo-China	99	.....	.....	.....	.....	.....
Madagascar and Dep.	34	.....	.....	.....	.....	.....
Martinique	1 617	.....	.....	.....	.....	.....
Mayotte Isl. and Dep.	60	.....	.....	.....	.....	.....
New Caled. and Dep.	4	.....	.....	.....	.....	.....
Reunion	1 373	.....	.....	.....	.....	.....
Tunis	2 138	.....	*d)* 4	.....	.....	.....
Australia	12 549	10 784	*a)* 7 074	7 435	12 049	*a)* 6 652
Canada frs.	279 806	312 060	*e)* 1 509 481	.....	.....	.....
British India	5 487	8 366	.....	.....	.....	.....
Mauritius	160	112	.....	.....	.....	.....
Italy	37 032	72 228	38 249	9 243	19 505	19 981
Japan	919	2 870	*b)* 1 134	501 026	14 989	10 207
Mexico	.....	80	*a)* 75	.....	.....	.....
Servia	18	.....	.....	.....	.....	.....
Switzerland	25 926	26 309	*a)* 25 749	7 487	10 999	*a)* 8 919

a) First half-year. — *b)* Jan.-Oct. — *c)* Jan.-Now. — *d)* First quarter. — *e)* Apr.-Oct.

The nature of the products varies with the different countries. In France, up to 1914, they included ground basic slag. In Italy the greater part of the superphosphate is included. In the United States the figures refer almost exclusively to compound manures exported more especially to other countries on the American continent (Canada, Mexico, etc.).

XIII. — Imports and Exports of Other Unclassified Manures.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
German New Guinea	69	.....	.....	.....	.....	.....
Belgium	42 085	43 038 *a)*	18 326	54 414	56 868 *a)*	23 039
Cuba	8 156	12 030	.....	14 721	.....	.....
Turkey	287	.....	.....	.....	.....	.....
Great Britain. Ireland	170 592	175 643 *a)*	91 217 *a)*	135 224	154 876	129 836
British India	288	670 *b)*	2 487	8 471	5 828 *b)*	5 695
Union of South Africa	38 953	57 935 *c)*	48 152	.....	.....	.....
Barbadoes	7 718	.....	.....	.....	.....	.....
Bermudas frs.	224 067	.....	.....	.....	.....	.....
Ceylon	4 163	.....	.....	.....	.....	.....
Cyprus	10 046	.....	.....	.....	.....	.....
Fiji	1 019	.....	.....	.....	.....	.....
Grenada frs.	127 237	.....	.....	.....	.....	.....
British Guiana frs.	14 899 618	.....	.....	.....	.....	.....
Leeward Islands frs.	325 053	.....	.....	.....	.....	.....
Jamaica frs.	184 822	.....	.....	.....	.....	.....
Mauritius	.....	206	.....	.....	.....	.....
Rhodesia frs.	219 754	.....	.....	.....	.....	.....
S. Lucia	5 853	.....	.....	.....	.....	.....
Trinidad and Tobago frs.	478 425	.....	.....	.....	.....	.....
Greece	625	9 257	.....	.....	.....	.....
Italy	19 640	12 854	18 664	19 977	28 623	22 370
Japan frs.	801 996	999 223 *c)*	379 502	366 277	243 267 *c)*	337 856
Norway	1 958	1 172 *c)*	1 108	.....	.....	.....
Netherlands	99 999	76 456	.....	51 835	84 982	.....
Russia	.....	.....	.....	5 160	5 373 *c)*	2 670

(*a*) First half-yar. — (*b*) April-Oct. — (*c*) Jan.-Oct.

The figures for British India in 1914 are those returned as "unenumerated manures"; from data received later they may be subdivided as follows:

	Imports — Jan.-Dec. 1914	Exports — Jan.-Dec. 1914
Bones	4878 m. tons	—
Fertilizers	274 »	—
Fish guano	43 »	10 422 m. tons
Other manures	713 »	5 710 »

XIV. — Imports and Exports of Sulphur.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	42 284	46 737 *a*)	29 772	1 746	3 472 *a*)	2 653
Argentine Republic	4 550	3 215	.....	.....	.....	.....
Austria-Hungary	41 023	39 442 *a*)	23 781	1 048	312 *a*)	59
Belgium	15 647	11 724 *a*)	4 193	6 745	6 745 *a*)	4 399
China	1 322	1 842	.....	.....	.....	.....
Denmark	.....	268 *a*)	280	.....	.....	.....
Turkey	4 768	.....	.....	57	.....	.....
Egypt	643	600	.....	.....	.....	.....
Spain	6 565	11 202 *b*)	10 354	4	2 *b*)	5
United States	27 315	14 870 *c*)	22 517	58 662	90 653 *c*)	99 556
France	172 181	186 348 *b*)	113 134	39 694	23 325 *b*)	14 477
Algeria	26 105	31 991 *a*)	30 013	.....	.....	.....
Great Britain / Ireland	22 098	18 505	442 966	1 856	731	.....
Canada	32 983	27 085 *d*)	34 748	.....	.....	.....
British India	5 841	6 428 *d*)	1 420	.....	.....	.....
New Zealand	2 034	.....	.....	.....	.....	.....
Greece	8 719	8 891	.....	.....	.....	.....
Italy	184	183	105	351 439	376 387	260 332
Japan	.....	.....	.....	49 131	54 256 *b*)	41 476
Norway	13 911	14 607 *b*)	8 368	.....	.....	.....
Netherlands	35 324	36 937 *c*)	15 436	14 341	10 216 *c*)	13 209
Russia	25 652	25 783 *b*)	20 623	.....	.....	.....
Servia	71	.....	.....	.....	.....	.....
Sweden	38 471	38 192 *e*)	17 891	.....	.....	.....
Switzerland	3 358	3 562 *a*)	2 371	.....	.....	.....

a) First half-year. — *b*) Jan.-Oct. — *c*) Jan.-Nov. — *d*) April-Oct. — *e*) Jan.-Sep.

Sulphur under all forms (crude or refined) is included in the above table. It is imported chiefly by the countries in which vine or fruit growing is specially well developed.

XV. — Imports and Exports of Sulphate of Copper.

Country	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	7 074	3 864	*a*) 4 448	3 812	4 012	*a*) 3 533
Argentine Republic	1 376	1 288	.....	.....	.....	.....
Austria-Hungary	16 132	6 937	*a*) 6 497	119	172	*a*) 203
Chile	221	.....	.....	.....	.....	.....
Denmark	.....	249	*a*) 157	.....	.....	.....
Turkey	1 623	.....	.....	15	.....	.....
Spain	7 121	6 433	*b*) 5 834	1	2	.....
United States	.....	.....	.....	3 097	1 910	*c*) 3 317
France	16 801	21 575	*b*) 23 468	6 904	5 312	*b*) 5 938
Algeria	4 612	3 609	*a*) 3 687	.....	.....	.....
Great Britain, Ireland	.....	.....	.....	84 124	76 843	68 973
Canada	1 153	606	*d*) 320	.....	.....	.....
Greece	2 524	2 027	.....	.....	.....	.....
Italy	36 568	30 450	21 906	1 387	522	1 814
Russia	2 310	672	5 078	.....	.....	.....
Servia	883	.....	.....	.....	.....	.....
Sweden	.....	.....	.....	513	250	*e*) 146
Switzerland	2 873	2 103	*a*) 2 023	66	62	*a*) 36

a) First half-year. — *b*) Jan.-Oct. — *c*) Jan.-Nov. — *d*) April-Oct. — *e*) Jan.-Sep.

The figures for Spain are those returned under the heading " insecticidal compounds and sulphate of copper " ; the figures for Russia are those returned under the heading " compounds used for checking diseases of the vine and of fruit trees ".

The producing countries are few (United Kingdom, United States and Germany) while the importing countries are characterised by having large areas under fruit and vines (Italy, France, Austria-Hungary, Algeria, Greece, Switzerland, etc.).

THE CONSUMPTION OF FERTILIZERS IN THE DIFFERENT COUNTRIES.

United States. — A certain number of the States have communicated provisional figures for the consumption of fertilizers during the season 1913-1914; these are given below together with corresponding figures for the previous year.

I. — Consumption of Fertilizers in Some of the United States.

State	End of fiscal year	1912-13	1913-14
		metric tons	metric tons
Alabama	Sep. 30	430 668	557 284
Arkansas	»	47 174	91 339
Georgia	»	1 016 674	1 133 981
Florida	Dec. 31	193 891	226 796
Kentucky		68 039	81 647
Louisiana	»	89 610	90 718
Maryland	»	153 314	181 437
Mississippi	Sep. 30	116 165	129 727
North Carolina	Nov. 30	762 441	898 113
South Carolina	June 30	833 101	979 760
Tennessee	May 31	76 258	81 647
Texas	Aug. 31	68 492	99 790
Virginia	Dec. 31	374 154	390 090
West Virginia	June 30	28 896	31 653
Total		4 258 877	4 973 982

Hungary. — The following data were communicated by the National Agricultural Society of Hungary. (See also, *Prod. et consom. des engrais chimiques*, 39-41).

II. — Consumption of Fertilizers in Hungary.

	1911	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Superphosphate:			
Production	.....	235 100	76 640
Imports	.....	2 120	.....
Exports	.....	470	.....
Consumption	.....	235 100	76 640
Potash salts:			
Imports	5 540	800	.....
Exports	.....	580	.....
Consumption	5 540	220	.....
Nitrate of soda:			
Imports	14 250	.....	.....
Consumption	14 250	.....	.....
Sulphate of ammonia:			
Production	3 500	4 000	2 000
Imports	1 380	1 220	200
Exports	500	530	.....
Consumption	4 500	2 100	1 400

Norway. — The following data were obtained from the experimental stations of Christiana, Trondhjem and Bergen through whose hands pass the greater part of the raw materials used in agriculture.

III. — Consumption of Fertilizers in Norway.

Fertilizers	1912
	metric tons
Basic slag	40 300
Supherphosphate	12 500
Potash salts	21 300
Nitrate of lime	5 500
Other fertilizers	5 000
Total	84 600

According to this direct estimate of consumption, the consumption per hectare in Norway amounts to 0.35 quintal (see, *Prod. et consom. des engrais chimiques*, 149-153).

It should be noted that the consumption of nitrate is entirely covered by the home production of nitrate of lime ; home production also accounts for half the superphosphate consumed, a third to a quarter of the potash manures (in the form of an extract from kelp ash containing 13 per cent of potash), and three fifths of the other fertilizers (in the form of fish guano and similar products). Large quantities of basic slag are used in the country and these are almost entirely imported. Two superphosphate factories exist in Norway, but of these, one closed down in 1913; the other is enabled to continue working owing to a local supply of pyrites and of apatite from Norway. (See also, Sebelien, J. *Die Jubiläumsausstellung Norwegens in Kristiania*, " Chemiker Zeitung " XXXVIII, 1144-1145, 1914).

Netherlands. — The following table has been drawn up from the 1914 Report of the Central Office of the Experiment Stations which deals with purchases of fertilizers and lime carried out under the control of the Stations during the last two years (DEPARTMENT VAN LANDBOUW, NIJVERHEID EN HANDEL, *Verslagen en Mededeeling van den Landbouw*, V, 24-25, 1914).

IV. — CONSUMPTION OF FERTILIZERS IN THE NETHERLANDS.

Fertilizers	1912	1913
	metric tons	metric tons
Basic slag	127 058	138 176
Superphosphate of lime	83 715	88 686
Double superphosphate	.....	.....
Superphosphate of ammonia	17 208	19 318
Bone flour	316	477
Natural guano	97	47
Other phosphatic fertilizers	942	860
Crude potash salts (kainite, etc.)	70 286	68 479
Potash manure salts	19 786	24 097
Sulphate of potash and magnesia	15 409	17 456
Other potash fertilizers	701	293
Nitrate of soda	53 448	49 223
Nitrate of lime	6	267
Sulphate of ammonia	3 498	6 941
Calcium cyanamide	504	1 778
Other nitrogenous fertilizers	58	202
Compound manures	3 873	3 999
Calcium carbonate	1 381	1 708
Caustic lime	1 017	1 015
Various	222	4 129
Total	399 525	427 151

The Department of Agriculture has further communicated directly to the Institute the following approximations of the total consumption of fertilizers in the Netherlands:

	metric tons
Basic slag (1913)	240 259
Superphosphate (1912)	120 000
Potash fertilizers (1913)	268 170
Nitrate of soda (1913)	82 490
Sulphate of ammonia (1913)	18 725

Portugal. — A communication from the Department of Agriculture of the " Ministerio de Fomento " states that the use of fertilizers is gradually spreading especially in the provinces of Alemtayo and Extremadura where the holdings are larger and under cereals and vines. In the central and northern regions where the holdings are smaller, the use of farm-yard manure is more general, and its production is estimated at 12 million tons per annum valued at 126 ½ million francs.

Of the fertilizers, phosphatic manures are the most important, especially in the corn regions, either under the form of superphosphate (12 per cent water soluble $P_2 O_5$) or of basic slag. With regard to superphosphate a condition of affairs exists in Portugal analogous to that already noted in Spain (*Prod. et consom. d'engrais chimiques*, 62) *i.e.* there has been a temporary over production made all the more serious by continued imports. Of the nitrogenous fertilizers sulphate of ammonia is used most, then nitrate of soda and finally calcium cyanamide has been introduced recently ; the use of potash manures (kainit and sulphate of potash) is also beginning. A typical dressing in the corn region would consist of :

	Kilog. per hectare	= Lbs. per acre
	—	—
Basic slag	300	268
Kainit	300	268
Calcium cyanamide	150	134

Total imports of fertilizers during the four years 1907-1910 fluctuated as follows :

	metric tons
	—
1907	123 213
1908	29 075
1909	102 653
1910	131 324

The imports in 1910 were valued at 8.7 million francs and it was in that year that the superphosphate industry attained its maximum development. The value of the present annual consumption is estimated at about 23 520 000 francs.

The following table has been drawn up from data supplied by the Department of Agriculture and by the " Companhia União Fabril " of Lisbon.

V. — Consumption of Fertilizers in Portugal.

Fertilizers	1912	1913
	metric tons	metric tons
Superphosphate:		
Production	(110 000)	126 000
Imports	.....	20 000
Consumption	.....	(100 000)
Basic slag:		
Imports	.....	70 000
Peruvian guano:		
Imports	.....	2 000
Consumption of phosphatic fertilizers	180 000	200 000
Kainit:		
Imports	3 075	2 186
Sulphate of potash:		
Imports	262	539
Muriate of potash:		
Imports	1 237	1 400
Nitrate of soda:		
Imports	.....	1 500
Sulphate of ammonia:		
Production	.....	2 000
Imports	.....	2 500
Calcium cyanamide:		
Imports	.....	2 000
Organic nitrogenous manures (fish, blood):		
Production	.....	10 000

According to this data, the consumption of fertilizers per hectare would be :

	quintals
Phosphatic manures	0.397
Potash »	0.008
Nitrogenous »	0.038
Total fertilizers . . .	0.443

Portugal therefore, though bordering on the third class, falls into the fourth class with regard to the amount of fertilizers consumed per unit area (see *Prod. et consom. des engrais chimiques*, 149-153).

VI. — World's Consumption of Sulphate of Ammonia.

Countries	1912	1913	1914
	metric tons	metric tons	metric tons
Germany	425 000	460 000	(450 000)
United States	250 139	266 850	(274 332)
Japan	87 000	115 000	.....
United Kingdom	91 444	98 557	(107 701)
France	90 000	97 000	.....
Spain and Portugal	45 000	75 000	.....
Java	57 000	68 000	.....
Belgium	42 000	45 700	.....
Italy	29 500	33 000	.....
Austria-Hungary	13 000	16 000	.....
Netherlands	8 000	8 000	.....
Egypt	1 650	2 000	.....
Sweden	1 300	1 350	.....
Denmark	70	300	.....

VII. — Exports of Sulphate of Ammonia from the United Kingdom.

Importing countries	1912	1913	1914
	metric tons	metric tons	metric tons
Germany	1 669	9 539	3 482
France	7 788	9 016	2 526
Spain and Canary Islands	67 238	61 828	65 178
Italy	13 759	5 915	5 141
Dutch Indies	34 073	37 715	55 749
Japan	88 050	116 422	89 184
United States	39 659	37 511	44 301
British West Indies	8 729	10 173	12 182
Other countries	28 651	40 119	41 169
Total	289 616	328 238	318 912

VIII. — Sulphur Exported from Sicily (1).

Importing countries	1913	1914
	metric tons	metric tons
Italy	81 474	95 548
Austria	36 335	25 308
Belgium	13 320	5 976
Denmark	305	240
France	75 186	61 873
Germany	31 968	18 824
Greece	14 615	15 758
United Kingdom	16 036	12 989
Norway	8 262	5 516
Netherlands	8 975	8 080
Portugal	14 757	8 426
Russia	25 892	21 289
Rumania	3 710	2 100
Spain	6 684	9 177
Sweden	19 542	18 360
Turkey in Europe	1 911	1 177
Canada	.....	512
United States	1 028	1 406
Argentine Republic	3 979	120
Brazil	2 425	706
Chile	712	96
Columbia	51	.....
Mexico	125	20
Peru	48	8
Venezuela	.....	.....
Egypt	615	1 260
Algeria	2 370	1 176
Tunis	872	1 052
Union of South Africa	13 741	2 486
Turkey in Asia	3 596	3 914
British India	5 736	4 313
Australia	13 441	1 637
Other countries	6 649	7 291
Total	414 360	336 638

(1) Figures supplied by the " Consorzio solfifero siciliano ".

PRICES OF FERTILIZERS AND CHEMICAL PRODUCTS FOR AGRICULTURAL USE.

Phosphates.

N. B. — *European prices are quoted per unit of 22.4 lbs.*
American prices are quoted per long ton.

I. — Tunisian Phosphate, 58-63 per cent (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of July, 1914	$4\,^{3}/_{4}$	5	5	$5\,^{1}{}_{4}$
August	—	—	—	—
September	—	—	—	—
October	$4\,^{1}/_{2}$–$4\,^{3}/_{4}$ (Genoa)	—	—	—
November	$4\,^{1}/_{2}$–$4\,^{3}/_{4}$ (Genoa)	—	—	—
December	$4\,^{1}/_{2}$–$4\,^{3}/_{4}$ (Genoa)	—	—	—

II. — Algerian Phosphate, 63-70 per cent (nominal quotations).

Markets	Mediterranean	United Kingdam	North Sea	Baltic
	d	*d*	*d*	*d*
End of July, 1914	—	$5\,^{3}/_{8}$	$5\,^{3}/_{8}$	$5\,^{5}{}_{8}$
» Aug.-Dec.	—	—	—	—

III. — Algerian Phosphate, 58-63 per cent (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of July, 1914	.....	5	5	$5\frac{1}{4}$
» Aug.-Dec. »	.....	.....	.....	.....

IV. — Florida Hard Rock, 77-80 per cent.

Markets	New York (Florida ports)	Mediterranean	United Kingdom	North Sea	Baltic
	$	*d*	*d*	*d*	*d*
End of July, 1914..	5.75–6.25	$6\frac{7}{8}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{7}{8}$
» August » ..	5.75–6.25	.....	.....	.....	.....
» September » ..	5.75–6.25	..... (Genoa)	.....	.....	.....
» October » ..	5.75–6.25	$6\frac{3}{4}$–$7\frac{1}{8}$	.....	.....	.....
» November » ..	5.75–6.25	7–$7\frac{1}{8}$	.....	.....	.....
» December » ..	5.75–6.25	7–$7\frac{1}{8}$	.....	.....	.....

V. — Florida Land Pebble, 68-73 per cent.

Markets	New York (Tampa)	Mediterranean	United Kingdom	North Sea	Baltic
	$	*d*	*d*	*d*	*d*
End of July, 1914..	3–3.25	$5\frac{1}{2}$	5	5	$5\frac{1}{4}$
» August » ..	3–3.25	.....	.....	.....	.....
» September » ..	3–3.25	..... (Genoa)	.....	.....	.....
» October » ..	3–3.25	$5\frac{1}{4}$–$5\frac{3}{8}$	.....	.....	.....
» November » ..	3–3.25	$5\frac{1}{2}$–$5\frac{7}{8}$	.....	.....	.....
» December » ..	3–3.25	$5\frac{1}{2}$–$5\frac{7}{8}$	.....	.....	.....

VI. — South Carolina Phosphate, 55-60 per cent.

Markets	New York (Ashley River)	Mediterranean	United Kingdom	North Sea	Baltic
	$	d	d	d	d
End of July, 1914 . .	3.50 — 3.75	5 (nominal)	4 3/4 (nominal)	4 3/4 (nominal)	4 7/8 (nominal)
» » August	3.50 — 3.75	—	—	—	—
» » September . .	3.50 — 3.75	—	—	—	—
» » October . . .	3.50 — 3.75	—	—	—	—
» » November . .	3.50 — 3.75	—	—	—	—
» » December . .	3.50 — 3.75	—	—	—	—

VII. — Tennessee Phosphate. 78-80 per cent.

Market	New York (Mt. Pleasant)	Mediterranean	United Kingdom	North Sea	Baltic
	$	d	d	d	d
End of July, 1914 . .	5 — 5.50	6 3/4 (nominal)	6 1/4 (nominal)	6 1/4 (nominal)	6 1/2 (nominal)
» » August	5 — 5.50	—	—	—	—
» » September . .	5 — 5.50	—	—	—	—
» October . . .	5 — 5.50	—	—	—	—
» » November . .	5 — 5.50	—	—	—	—
» » December . . .	5 — 5.50	—	—	—	—

VIII. — Christmas Island Phosphate (nominal quotations).

Market	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of July, 1914	8 1/2	8	8 1/4	8 1/2
» » Aug.-Dec.	—	—	—	—

IX. — Ocean Island Phosphate (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	*d*	*d*	*d*
End of July, 1914	8 1/2	8	8 1/4	8 1/2
» » Aug.-Dec.	—	—	—	—

Nitrogenous Fertilizers.

X. — Nitrate of Soda, price per long ton on the spot.

	Antwerp	Dunkirk	Genoa	Hamburg	London	New York	Rotterdam
	£ *s d*	£ *s d*	£ *s d* £ *s d*	£ *s d*	£ £ *s*	£ *s d*	£ *s d*
End of July, 1914.	9 5 4	9 12 7	9 17 5 – 10 1 5 (Feb.-March. 1914)	9 11 0	11 — 11 10	9 11 0	9 10 11
» August »	—	—	—	—	11 — 11 10	9 11 0	—
» Septem. »	—	—	£13 13*s* 11*d*	—	11 — 11 10	8 14 11	—
» October »	—	—	11 5 7–11 9 7	—	11 — 11 10	8 14 11	—
» Novem. »	—	—	12 9 9–12 13 10	—	11 — 11 10	8 14 11	—
» Decem. »	—	—	12 17 10–13 1 10 (Jan. 1915)	—	11 — 11 10	8 14 11	—

XI. — Sulphate of Ammonia, price per long ton on the spot.

	Antwerp (comptoir)	Genoa	London	New York	Paris
	£ *s d*	£ *s d* £ *s d*	£ *s* £ *s*	£ *s d*	£ *s d*
End of July, 1914.	11 5 7 (Oct.)	12 1 9–12 3 9	12 5 — 13 0	11 19 4	11 9 7
» » August »	—	—	11 0 — 11 10	11 19 4	—
				£ *s d* £ *s d*	
» » Sept. »	—	£13 5*s* 11*d*	12 5 — 13 0	11 14 9–12 8 7	—
» » Oct. »	—	13 3 10–13 7 11	10 10 — 11 0	11 14 9–12 17 9	—
» » Nov. »	—	13 11 11–13 13 11	10 10 — 11 0	11 14 9–12 17 9	—
» » Dec. »	—	14 2 0–14 6 0	10 10 — 11 0	11 14 9–12 17 9	—

XII. — Comparative Prices of Nitrate of Soda (1) and of Sulphate of Ammonia (2) during 1914 (per long ton).

Week ending	Nitrate of soda	Sulphate of ammonia	Week ending	Nitrate of soda	Sulphate of ammonia	Week ending	Nitrate of soda	Sulphate of ammonia
	£ s d	£ s d		£ s d	£ s d		£ s d	£ s d
Jan. 3	12 13 9	10 10 0	May 2	11 18 9	10 0 0	Sept. 5	10 10 0	10 15 0
» 10	12 8 9	10 10 0	» 9	11 12 6	10 0 0	» 12	10 8 9	10 15 0
» 17	12 5 0	10 7 6	» 16	11 3 9	9 17 6	» 19	10 6 3	10 7 6
» 24	12 5 0	10 7 6	» 23	11 1 3	9 17 6	» 26	10 6 3	10 7 6
» 31	12 5 0	10 7 6	» 30	10 13 9	9 17 6	Oct. 3	10 7 6	10 0 0
Feb. 7	12 7 6	10 7 6	June 6	10 11 3	9 17 6	» 10	10 12 6	10 0 0
» 14	12 10 0	10 10 0	» 13	10 8 9	9 17 6	» 17	10 17 6	10 0 0
» 21	12 12 6	10 10 0	» 20	10 7 6	9 17 6	» 24	10 16 3	10 0 0
» 28	12 8 9	10 12 6	» 27	10 10 0	9 17 6	» 31	10 16 3	10 0 0
Mar. 7	12 7 6	10 12 6	July 4	10 15 0	9 17 6	Nov. 7	10 15 0	9 15 0
» 14	12 10 0	10 12 6	» 11	10 18 9	9 17 6	» 14	10 15 0	9 10 0
» 21	12 7 6	10 12 6	» 18	10 18 9	9 17 6	» 21	10 17 6	9 10 0
» 28	12 5 0	10 10 0	» 25	11 0 0	9 17 6	» 28	11 0 0	9 10 0
April 4	12 3 9	10 10 0	Aug. 1	10 17 6	9 17 6	Dec. 5	11 1 3	9 10 0
» 11	12 5 0	10 7 6	» 8	10 17 6	11 5 0	» 12	11 8 9	9 15 0
» 18	12 5 0	10 5 0	» 15	10 13 9	11 5 0	» 19	11 15 0	10 0 0
» 25	12 8 9	10 2 6	» 22	10 11 3	11 5 0	» 26	12 0 0	10 0 0
			» 29	10 11 3	11 0 0			

(1) Liverpool, available, 95 per cent. — (2) Hull, f. o. b., good grey, 24 per cent NH_3.

Potash Salts.

As the more concentrated salts, *i. e.* the muriate and sulphate of potash, yield on analysis a rather higher potash content than the minimum declared, the Potash Syndicate have slightly raised prices for Germany during 1915. Exports from Germany are prohibited without special permission.

XIII. — PRICES OF POTASH SALTS AT NEW YORK, JULY-DEC. 1914 (per long ton).

	Kainit	Hartsalz	Potash manure salts	Double manure salts	Sulphate of potash	Muriate of potash		
						80-85 %	95 %	98 %
	$	$	$	$	$	$	$	$
End of July	8.36	10.87	13.58	25.04	45.57	41.65	40.75	39.07
» Aug.-Dec.	8.56	11.07	13.78	25.54	48.07	42.15	41.25	39.57

Chemical Substances for Agricultural Use.

XIV. — PRICES OF SULPHATE OF COPPER (per long ton).

	London		Mediterranean		New York
	£	£ *s*	£ *s* *d*	£ *s* *d*	£ *s* *d*
End of July, 1914	20	20 10	20 14 11	21 1 0 (March-April 1915)	20 14 2
August	20	20 10	—		20 14 2
September	20	20 10	—		20 14 2
October	20	20 10	£22 1*s* 1*d* (Feb.-March 1915)		20 14 2
November	20	20 10	21 7 0 (Jan.-March 1915)	21 11 1	20 0 4
December	21	21 10	23 3 3	23 7 4	20 0 4

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FIRST PART.

ORIGINAL ARTICLES

The Tobaccos Grown in Italy

by

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The cultivation of tobacco in Italy has developed only to a limited extent and it does not appear to extend as would be desirable. A gradual increase took place from 1901 to 1911. The area under tobacco for the Monopoly, which in 1901 amounted to 12 372 acres, rose to 18 942 acres in 1910 and to 18 355 acres in 1911, but in 1912 it fell to 16 965 acres. The area under tobacco grown for exportation, has diminished also; in 1909 this area has reached 3 745 acres but sank to 2 722 acres in 1910, to 882 in 1911 and to 705 in 1912.

The object of this paper is to show the importance of tobacco growing in Italy and to describe the varieties that are cultivated in the country.

The numerous species, varieties and strains of this plant, that have been obtained by selection, crossing, acclimatizing etc. form four sections: *Nicotiana petunioides, N. polidiclia, N. rustica* and *N. tabacum.* The latter is the most important, as it includes the best smoking tobaccos. Comes was the first to classify the numerous species of this section, and grouped them in six varieties: *havanensis, brasiliensis, virginica, lancifolia, fruticosa* and *macrophylla.* Later Anastasia availing himself of the interesting studies conducted by Angeloni, by Splendore and by Anastasia himself at the Scafati Experimental Institute for the cultivation of tobacco, reduced to four the typical varieties of *N. tabacum* namely; *havanensis, brasiliensis, virginica* and *purpurea,* as he had recognized that *lancifolia* is a cross between *virginica* and *brasiliensis* and that *macrophylla* and *fruticosa* are also the result of crosses derived from a new strain, *purpurea,*

in its turn a cross between *tabacum* and another not well determined *Nicotiana*. The characters of these four varieties of tobacco are found in the general appearance of the plant and of its inflorescence, in the details of the leaves, of the flowers, capsules and seeds, etc. With the exception of *havana* which is found pure (Vuelta Abajo) in some districts of Cuba, all the strains of cultivated tobacco are the results of crossing, in which the characters of the predominant strain are more manifest.

The varieties of tobacco cultivated in Italy are about a score, one half of them are Italian strains, such as Brasile Beneventano, Brasile Leccese, Brasile Selvaggio, Cattaro di Lecce, Erbasanta, Moro di Cori, Nostrano del Brenta, Rigadio, Secco, Spadone and Spagnuolo, and the others are foreign, some of them American such as Burley, Kentucky, Maryland, Virginia and the rest are Eastern as Ayasolouc, Herzegovina, Porsuciam, Sansum, and Xanty Yakà. Brasile Leccese, Brasile Selvaggio and Erbasanta are varieties of *N. rustica* var. *brasilia* the remainder both Italian and foreign belong to *N. tabacum* and are crosses of *N. havanensis, brasiliensis, virginica and purpurea.*

Among native Italian tobaccos the most important is Nostrano del Brenta; it is a cross between *brasiliensis, havanensis* and *purpurea* similar to the Szegedin of Hungary from which perhaps it originated. The plant in bloom reaches at most the height of 4 ft. 4 in. and it bears 20-24 leaves, of a vivid green, ovate, very broad at their base and narrowing before their insertion to form a kind of winged stalk. The inflorescence is a panicle of flowers with a rose coloured sub-pentagonal corolla having apiculated lobes. On average six leaves are kept and they are gathered at advanced maturity. It presents three types: " avanone ", " avanetta " and "cucchetto". In avanone the Brasil ancestry is predominant, in some avanettas the leaves are smooth, in others curled or round; in cucchetto the *havanensis* characters are more manifest than in any other Italian variety.

The cured leaves are light coloured, uniform, of fine texture, more or less combustible and contain an average of 2.5 per cent nicotine in the dry matter. They are mostly used for smoking purposes and the least combustible leaves are converted into snuff. The largest leaves measure 22.8 in. × 12.8 in. and weigh 15 grams, the average size is 16 in. × 10 in. and weighs 12 gms., while the smallest leaves are 8 in. × 4 in. and weigh 3 gms.

Secco di Sardegna is a hybrid of *brasiliensis, havanensis* and *purpurea* in which the characters of the first predominate. The plant is about 4 ft. 8 in. high, of a conical shape not so slim as Nostrano; it bears 15 to 16 leaves of a bright green colour ; they are smooth with bent edges, lying close to the stem, and having thick light coloured ribs ; the internodes are short. The panicle is a decided sub-corymb, the flowers are red with ovate lobes. When grown under irrigation the product is called " Rigadio ".

The leaves of Secco are ovoid, elliptic, with a sharp point, light chestnut colour, with yellowish and reddish shades or golden yellow with green or chestnut shades ; the tissue is not very elastic, but leathery ; the aroma is pleasant. Being very combustible the leaves are used for cut tobacco and cigarettes but they are also converted into snuff. The leaves of Riga-

dio are more developed; they are coarse, rough, spongy, of a light chestnut colour or yellowish, uneven, and they are used exclusively for the preparation of snuff. The dimensions and average weight of Secco leaves are 18.4 in. × 8 in. and 10 gms. for the large ones, 16 × 7.2 in. and 7 gms. for the medium sizes, 10 × 4 in. and 4 gms. the small ones. The dimensions and weights of the corresponding Rigadio leaves are respectively: 27.2 × 10.4 in. and 20 gms.; 20 × 7.2 in. and 12 gms.; and 14 × 4.8 in. and 6 gms.

The Spadone di Chiaravalle is a cross between the *brasiliensis* and *havanensis*, in which the former is predominant, and contains also traces of *purpurea*. The plant attains the height of 6 ft., it bears 20 to 25 leaves of a fine deep green colour, elongated ovate in shape, smooth, narrowing at the base, with a sharp point and divergent and bent edges; the leaves are erect, very close to the stem and the internodes are short. All these are characters of the Brazil tobacco, while the Havana characters show in the basal leaves which are horizontal, and in the inflorescence which is a sub-corymb with red flowers having broadly ovate lobes.

The cured leaves are of a uniform golden yellow or chestnut colour; the texture is spongy, fleshy, sticky, possessing a sweet aroma. The leaves contain an average of 4.7 per cent of nicotine; not being very combustible they are used almost exclusively for the preparation of choice snuffs. The dimension and weights of the yellow leaves are 23.2 × 12 in. and 12 gms. for the large ones, 20 × 8 in. and 9 gms. for the medium and 12.8 × 6 in. and 5 gms. for the small ones. The chestnut coloured leaves are heavier weighing respectively 18, 10 and 7 gms.

Brasile Beneventano grows to a height of 5 ft. 8 in. and is a handsome plant. It is a cross of between the Brazil, Havana and Virginia tobaccos with predominant Brazil characters. The leaves are 25 in number and are of a green intermediate between that of *brasiliensis*, and that of *verginica;* they are longish and rather narrow, with divergent tips, their surface is smooth and glossy; the secondary ribs are thin and form obtuse angles with the main rib; the leaves are erect, very close to the stem; the internodes are short. The flowers are red with widely ovate lobes and form a somewhat compact corymb panicle. The leaves when air cured have a soft elastic tissue, delicate aroma, light uneven chestnut colour; when fire dried their colour is dark chestnut. Possessing a good combustibility they are used for cut tobacco, cigars and cigarettes. The dimensions and weights of the leaves vary between a maximum of 34 in. × 12 in. and 27 gms. and a minimum of 10 × 3.2 in. and 3 gms. according to the locality in which the tobacco is grown (Benevento and S. Giorgio in the Benevento territory, Pontecorvo in Terra di Lavoro and Barcelona in Sicily).

Moro di Cori is a hybrid between *havanensis* and *purpurea*, which reaches the height of 5 ft. 4 in. and bears from 20 to 25 large leaves (the upper ones, however, are very small); the leaves are almost horizontal, heartshaped, subcordate at their base, sessile or with a winged or sometimes crenelated stem and with a curly bract at the point of insertion. This tobacco is very rich in nicotine (upwards of 5 per cent) and has an agreable almond-like aroma. It is used for snuff which was formerly much esteemed. The dimen-

sions and weights of the large, medium and small leaves are respectively 20.8 × 16 in. and 16 gms., 16.8 × 12.4 in. and 10 gms., and 10.4 × 5.2 in and 4 gms.

Spagnuolo di Comiso is a cross between *havanensis*, *brasiliensis* and *purpurea*, in which the Havana characters prevail, especially in the basal leaves whilst the highest leaves approach more the Brazil type. The plant grows to a height of 6 ft. 2 in. and bears from 20 to 25 leaves very rich in nicotine, oblong shaped, either sharp or ovate, of a light chestnut colour or yellow, not very uniform and with brown or greenish patches. Owing to their sweet fragrance they are used for the best kinds of snuff, but they are not suitable for smoking on account of their low combustibility. The dimensions and weights of the leaves vary from 27.2 × 12 in. and 23 gms to 12 × 6 in. and 5 gms.

Cattaro di Lecce is a hybrid of *brasiliensis* and *virginica* with predominance of the former ; the plant grows to upwards of 6 ft. 8 in. and is the tallest, most vigorous, robust and coarse of the *tabacum* group. The green, lanceolate, long, narrow, pointed leaves with a somewhat diverging tip, and sinuous edge, have large auricules and thick ribs. They are inserted at short internodes and number sometimes as many as 100 on one plant (usually though about 40 to a height of 5 ft. 8 in.). The flowers are red and form a large sub-corymbous panicle. The variety is grown with and without irrigation. The cured leaves of the non-irrigated Cattaro are of a deep chestnut colour ; those of the irrigated plants are light chestnut with yellow or greenish stripes or patches. They contain from 4 to 7 per cent of nicotine. The irrigated Cattaro has an excellent aroma and is used for snuff. The non-irrigated is used for cut tobacco, the finest and most combustible leaves being devoted to this purpose. The dimensions and weights of the leaves are : for the irrigated plants, large leaves 32 in. × 7.2 in. and 18 gms ; medium leaves 26 × 6 in. and 14 gms ; small leaves, 22 × 4.8 in and 12 gms. For the non-irrigated plants, 26 × 4.8 in. and 12 gms ; 20 × 4 in. and 10 gms ; and 15.2 × 3.2 in. and 8 gms. respectively.

Brasile Leccese, Brasile Selvaggio and Erbasanta are of medium size and bear from 18 to 20 cordate leaves, with a long stem ; the leaves are longer in the Selvaggio and rounder in the Erbasanta. The first used to be grown at Nardò in the district of Lecce, but is no longer grown there ; Selvaggio is now produced in Sicily, at Palermo and Partinico ; Erbasanta is grown in the Salerno district at Cava dei Tirreni, and at Nocera Inferiore.

The best qualities of Selvaggio leaves are dark green while the inferior qualities are of a faded green, they are also smaller, less rounded and heavier. The Erbasanta leaf is uniform chestnut colour, sometimes yellowish ; the Leccese is of a greenish yellow, is more developed and not so round, its stem is shorter and thicker, and its aroma sweeter ; it is also richer in nicotine (10-11 per cent). The dimensions and weights of the large Brasile Leccese leaves are 17.2 × 12 in. and 26 grams ; of the medium leaves 15.2 × 8.8 in. and 17 gms. ; and of the small ones 13.2 × 6 in. and 10 gms. The dimensions and weights of the three sizes of Brasile Selvaggio are : 18.4 × 8.8 in. and 26 gms ; 14 × 7.2 in. and 18 gms ; and 12 × 6 in. and 17 gms. Those

of Erbasanta are: 16 × 12 in. and 16 gms; 14 × 6.4 in. and 12 gms; 12 × 4.8 in. and 10 gms.

Tobacco from foreign seeds is grown only to a limited extent: among those of American origin the chief are Kentucky, Virginia and Burley; and among the eastern tobaccos; Herzegovina, Xanti Yakà, Porsuciam, Ayasolouc and Sansum. The leaves of the American tobaccos are rather large, mostly chestnut coloured or yellow like Virginia and strong flavoured; The Eastern tobaccos are medium and small sized, light yellow coloured and their aroma is sweet and delicate.

The most important foreign variety is Kentucky, of which 11 million pounds are produced, or about two thirds of the whole national produce. This is a hybrid of between Brazil, Virginia and Havana tobaccos, in which the characters of Virginia predominate. The plant is robust, about 5 ft. 10 in. high. It bears from 18 to 20 auriculated lanceolate leaves of a fine deep green colour with acute and alternating secondary ribs; the lamina is undulated and the leaves are attached to short internodes and pendulous, the tips being lower than the point of insertion. All these are characters of the Virginia strain; the Brazil ancestry shows in the slightly divergent tips and in the highest leaves which are sometimes erect and very close to the stem. The inflorescence is a sub-corymbous panicle. This tobacco is grown all over the peninsula and in the islands. It yields an excellent leaf especially in the Roman Campagna, in Tuscany, Campania and Calabria.

The cured leaves are of a fine chestnut colour gummy, elastic, compact, combustible, with pleasant taste and aroma, especially in the produce of the Roman Campagna and Tuscany which most resemble the original produce. They are used both for the filling and for the wrapper of fermented cigars; the heaviest and darkest leaves are used for cut tobacco, the smallest and lightest for cigarettes. The dimensions and weights of the three sizes of leaves are respectively: 30 × 14 in. and 20 gms; 22 × 10 in. and 14 gms.; and 12.8 × 6 in. and 8 gms.

Less important from the point of view of quantity grown are Virginia and Burley. These are grown chiefly in the districts of Lecce. They are crosses in which Virginia characters predominate.

Virginia Bright grown in Italy presents characters which are intermediate between the original V. Dark and V. Bright. The plant, 5 ft. high and bears from 18 to 20 medium sized leaves, semi-erect, with the characters of Havana tobacco. The flowers are red and form sub-corymbous panicles. The leaves are of a more or less lengthened ovate form, narrow at their base, yellowish or lemon yellow, not so greenish as in the original leaf; they have a good combustibility but not much elasticity, and are used for the manufacture of Virginia cigarettes. The dimensions and weights are: 18 × 8.8 in. and 6 gms.; 12 × 6.4 in. and 4 gms; and 8 × 4 in. and 2 gms.

The Burley plants are as tall as the Kentucky and bear from 20 to 22 leaves of a pale green colour, the lowest of which are pendulous, the highest erect; they are lanceolate, sometimes elliptic with a sharp apex and nar-

row at their base. After being cured their colour is light or straw yellow, their texture is spongy their combustibility is imperfect ; they do not possess much aroma and their taste is not very agreable. They are used for cigars, cigarettes and cut tobacco. Their dimensions and weights are : 29.2 × 11.2 in. and 18 gms ; 21.2 × 8 in. and 12 gms ; 12 × 6 in. and 5 gms.

Among the Levantine tobaccos grown in Italy the most important are Herzegovina and Xanti Yakà.

Herzegovina is a cross between *brasiliensis*, *havanensis* and *purpurea*; it does not grow high, about 40 inches, and has a squat appearance; its leaves, from 22 to 25, are sessile, orbicular, smooth, glossy, very erect. The flowers are not red but have all the characters of those of *purpurea* with corolla tubular to the apex, pentagonal fauces and a white star on the inside ; they form a contracted panicle almost enveloped in the apical leaves. The variety is grown almost exclusively in the province of Lecce as it requires a warm, dry climate, but little rain in May and June and none in July and August. It prefers a calcareous loam rather undulated than flat; the Italian product is more delicate than the original one. The uncured leaves are ovate elliptical in shape, with curved tips, yellow coloured, often with reddish patches ; their taste and aroma are pleasant. They are used in the manufacture of Macedonia cigarettes and the inferior leaves for the Virginia cigarettes. Their dimensions and weights are 12 × 6 in. and 1.5 gms; 8 × 4.8 in. and 1 gm.; 3.2 × 2 in. and 0.5 gm.

Xanti Yakà is the most aromatic of the Macedonian tobaccos; the plant which grows to a height of 5 ft. presents the characters of *purpurea* to marked degree. It is elegant and slim, of cylindrical outline; it bears 22 to 26 sessile, sinuous, erect, elliptical, long leaves with a pointed tip, not much narrowed at their base and possessing small auricles. It is grown in the province of Lecce and in the Abruzzi where it has gained a firm footing and yields a product in no wise inferior to that obtained in its country of origin. It is grown and cured as in Herzegovina, and the cured product consists of small elliptical long or ovate leaves with a sharp curved tip, and a narrow base, the edges of the leaves are sinuous, their secondary ribs are at right angles to the main rib, especially in the leaves at the base of the plant, their colour is a bright golden yellow; the texture of the leaves is delicate, they are agreably aromatic and possess a sweet taste, but are, however, not very combustible. The best leaves are used for the Macedonia cigarettes, the worst for the Virginia. Their dimensions and weights are: 6 × 3.2 in. and 0.6 gms; 4 × 2.4 in. and 0.4 gms; 2.4 × 1.2 in. and 0.2 gms.

The interesting studies of ANGELONI on the " Constitution and fixation of the strains of tobacco by means of crossing " have led to the formation of new types among which are to be mentioned Italy × Kentucky, the former in its turn being a Kentucky × Sumatra Rano (*havanensis-purpurea*). The field culture of this tobacco which combines the robustness of Ken-

tucky with the delicacy of tropical tobaccos has already given excellent results (1).

From the above it will be seen that the Italian tobaccos of native strains are only partially suitable for smoking purposes being used to only to a limited extent in the manufacture of cigars and cigarettes and not much more as cut tobacco, but they are very suitable for the preparation of snuffs, and yield some of the most esteemed kinds. But as the habit of taking snuff is rapidly disappearing the Italian strains for snuffs are less grown every year. On the other hand the best smoking tobaccos such as Nostrano, Secco and Brasile Beneventano are on the increase. The cultivation of tobaccos from foreign seeds is more important than that of native tobaccos and the yield is twice as great. On the whole, however, the yearly output of the country (about 20 million pounds) is barely one quarter of the quantity that is bought every year by the Monopoly. This production might be very considerably increased, because the cultivation of tobacco is as profitable as that of any other staple. The conditions of climate and soil in Italy are almost everywhere favourable to this crop, the yield per acre is often superior to that obtained in the greatest centre of production and the quality of the product is generally very good. The Kentucky of some regions, such as the Roman Campagna, Tuscany, Abruzzi, Calabria and the district about Salerno bears comparison, as regards strength and taste, with that of the United States. Virginia tobacco has also given good results in several regions and the Levantine tobaccos, especially Xanti Yakà, grown in the provinces of Lecce and of the Abruzzi have such an exquisite aroma, perfume and delicacy of texture that they can stand the competition of Macedonian tobaccos even on foreign markets.

Certain difficulties are met with in growing this crop; in order to obtain good leaf tobacco complex operations are necessary and these may be divided into two groups : a) *agricultural* or *farming operations* and b) *industrial operations*.

The former include : preparation of the soil (ploughing, spading, manuring etc.), sowing, transplanting, hoeing, earthing up, topping and harvesting, which are performed as for any other crop. The industrial operations are divided into *curing* and *fermentation*. By curing, the green leaves, either threaded together or left on their stems according to the system of harvesting, are subjected to a series of treatments during which, owing to the action of the oxygen of the air, of moixture, of the sun's heat or of artificial heat, they undergo a profound transformation in their external characters and in their chemical composition. The bright green colour becomes yellow, chestnut or brown according to the system followed. The greater part of the water content is eliminated, the tissue becomes more tough and elastic, the characteristic perfume and aroma of tobacco is dev-

(1) For perther particulars on Italian tobaccos, the numerous publications of the Ministry of Finances, General Direction of the Monopoly may be consulted, especially those of ANGELONI, SPLENDORE, ANASTASIA, SPARANO, BENINCASA and Prof. COMES.

eloped, while the organic substances contained in the leaf act and reac upon each other. These complex alterations are then completed by *fer mentation*, which is brought about by packing the cured leaves in smal bales covered with canvas, in wooden casks or in large heaps, opportunel moving them so as to prevent the heat produced by fermentation and che mical reactions from becoming too great and thus damaging the product

Before fermenting the leaves, they are *classified* and made into bun ches (*affascicolamento*) and the leaves are detached from the stem whe this has not already been done at harvest time (*sfogliettatura*). Of al these manipulations curing requires most care because it is during thi process that the tobacco is formed. As with the best grapes, very bad win can be made, if the complex operations involved in wine-making are no carefully carried out, so an excellent plant of tobacco can yield a very infe rior product if curing is done carelessly.

The production of raw tobacco is thus a real agricultural industr which requires special technical knowledge on the part of the growers, an the product will be all the better the more the growers are aware of the im portance and the delicacy of the various operations they have to carry out Very often it happens that plants grown on adjoining plots under the sam conditions of climate and culture, and which are identical in the green stat give rise to quite different tobaccos according to the care with which th curing is carried out.

In order to improve and consequently, to develop the production o tobacco it is indispensable that tobacco growing should be considered a a great agricultural industry. Considering the nature of curing operation it is not always possible for every small grower to have the necessary equip ment and skill ; it should therefore be done by suitable establishments i each area of production. And it would also be a great advantage if th grower were left free either to export his tobacco or to sell it to th Monopoly.

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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

243 - **Act No. 2380, Providing for the Inspection, Grading and Baling of Abac (Manila Hemp), Maguey (Cantala), Sisal and other Fibres in the Philippin Islands.** — *The Philippine Agricultural Review*, Vol. VII, Nos. 10-12, pp. 373-38 Manila, P. I., December 1914.

The Director of Agriculture is enjoined to establish, define and desig nate standards for the commercial grades of abaca, maguey and sisa which shall become the official standards of classification throughout th Philippine Islands. He shall also organise six months before this Ac comes into force, in the ports of export, the offices in which the gradin of the fibres shall be practised. Similar offices shall likewise be organise at the request of a party concerned at any point in the Archipelago.

No person, association, or corporation shall engage in grading fibr unless a "grading permit" has been previously obtained and signed by th Director.

All private marks or brands shall be registered with the Director o Agriculture who may cancel it after one month's notice if it is proved tha such brand or brands have not been constant or have lead to mistakes o confusion.

All fibres included in this Act which are intended for export shall b pressed into bales approximately of the following dimensions and weight length one metre; width 50 cms.; height 55 cms.; and weight 125 kilos ne

In order to supervise the grading and baling of the fibres at the variou stations and to ensure adherence to the provisions of the Act, the Direct

f Agriculture is authorised to organise a "fibre inspection subdivision" which shall be subsidiary to the fibre division of the Bureau of Agriculture.

In addition to the work of inspection a certain number of fibre inspectors shall be detailed from time to time for educational work among he fibre producers in any district in the Philippine Islands.

The provisions of this Act shall take effect from January 1, 1915.

44 - **Agricultural Development in the Gold Coast.** — EVANS, A. E. (Acting Director of Agriculture, Gold Coast Colony). — *Report on the Agricultural Department for the Year* 1913, pp. 72. Government Press, Accra, 1914.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES,

The Department of Agriculture has organised classes of instruction for he natives and out of the 58 students in attendance 46 succeeded in gaining certificates. School gardens have also been established in connection with the courses. With a view to improving the cultivation of cacao, 4 men, nominated by native chiefs were given a short course of training before acting as travelling instructors. Five small model farms were also started to serve as demonstration areas, but, owing to the negligence of he native chiefs, they have not been a success.

The exports of cacao have increased 30 per cent, but this is not due to better cultivation. The native farmer prefers the opening up of new land o the cleaning of old plantations, and a short-lived plantation of 500-800 rees per acre gives better results to the native than a more rational system f cultivation. Consequently conditions are very favourable to the spread f diseases and pests. The two very serious cacao pests *Salhbergella* and *Helopeltis* are being investigated by the entomologist.

Palm products (oil and kernels) show a decrease due to the neglect of his tree on account of low prices and the heavy labour required compared with cacao. Large areas of palms are neglected and the destruction of he trees has required Government interference with the native practices. The yield of wild rubber is declining owing to low prices and the development of cacao. Hevea trees are reaching the tapping stage and the natives re applying for instruction in the best methods of preparation. Trees f 37 inches girth have yielded an average of 3 lbs. of rubber per annum. The cultivation of coconuts has not yet been attempted systematically owing o the time required for them to come into bearing. There is no legislation gainst coconut pests.

The cultivation of cotton is encouraged by the British Cotton Growing Association which buys all seed cotton grown in the colony and distributes seed for planting. Notwithstanding this the yields are low and acao offers more attraction at present.

The export of cola nuts has declined slightly through the value has ncreased £ 10 000. The industry is entirely in the hands of the Hansas who collect the nuts from the forest trees and exercise great care in harvesting them free from insect attacks. The cultivation of cereal crops is very ackward and considerable quantities are imported.

The report includes an appendix of agricultural and meteorological tatistics.

245 – **Agriculture in Japanese Korea (Chosen), in Formosa (Taiwan) and in Japanese Sakhalin (Karafuto).** — *Ministry of Finance, Financial and Economical Year Book of Japan, Fourteenth Year*, pp. 170-202. Tokyo, 1914.

Japanese Korea. — Japanese Korea is a predominantly agricultural country, but the methods of agriculture are very primitive; the rivers have no embankments, and neither irrigation nor drainage is practised, hence every year the extent of land left without cultivation increases owing to the damage caused by the floods. In general small farms prevail. Rice is the chief product of the soil, next in order of importance are : wheat, barley, millet, sorghum and beans.

Among the industrial crops the chief are cotton, tobacco, hemp, and ginseng. The latter which grows in the neighbourhood of Kai-song in the province of Kyeng-ki, stands unrivalled as material for the preparation of medicinal ginseng and is the most remarkable product of Korea. The preparation and sale of this product were monopolized in 1899, and in 1908 the monopoly was taken over by the National Treasury. The crop of late has been much injured especially by the occurrence of disease. The area under ginseng increases every year. When all the present plantations are in full production (sixth year) the value of the yearly crop will be considerably over 3 million yen (about £300 000).

The total area of the forest lands of Japanese Korea is estimated at 16 million chô (1 chô = 2.4507 acres) but only about 5 million chô are really wooded ; the rest is made up of bare or scrub covered hills. The principal State forests are in the mountains where the Jalu, Tumen, Taïdong and Han have their sources. To the south of the Taïdong the principal species are *Pinus dentiflora* and different oaks (*Quercus dentata, Q. mongolica, Q. alicha*, etc.,) to the north of the same river *Pinus koraiensis, Larix dahurica, Picea hondoensis* and *Abies veitchii* are prevalent.

The breeding of oxen, horses, goats and pigs is practised everywhere as a secondary industry connected with agriculture, but it has no great importance and is not practised anywhere as a specialized industry. The cattle of Korea is renowned for its large size and for other good qualities, and fairly large numbers are exported to Japan and to Russia in Asia.

In 1913 the exports from Japanese Korea amounted to about £3 200 000 ; of this amount 67 per cent was formed by cereals and seeds, 6.2 by food and beverages, 3.7 by raw and woven cotton and 2.7 by drugs, oils and wax.

Formosa. — The principal agricultural products of Formosa in 1912 were the following :

Rice	20 071 190	bushels
Tea	14 803	short tons
Sugar	193 512	»
Sugar-cane	2 089 695	»
Sweet Potatoes	74 591	»
Ramié	951	»
Jute	2 684	»
Indigo	12 996	»

Rice is cultivated everywhere in Formosa except in the Hôkotô (Pescadores) Islands; where there is sufficient water, two crops a year are raised. The production of rice has much increased of late years.

The cultivation of sugarcane and the manufacture of sugar were introduced into Formosa about the sixteenth century, but it is only recently that sugar factories with modern machinery have been erected. In 1911-12 there were 31 refineries.

The forests of Formosa abound with useful trees. In the higher forests the prevalent kinds are *Abies* spp., *Tsuga* spp., *Chamaecyparis* spp., *Pinus* spp., in the lower ones *Quercus* spp., *Cinnamomum* sp. (camphor), *Machilus* spp., *Bambusa* spp. Of these camphor is the most important. Experiments are being carried out for the purpose of introducing into Formosa the growing of rubber, teak, cocoa and *Agave sisalana*. Opium, camphor, and tobacco are State monopolies. The first however is subject to gradual prohibition.

Japanese Sakhalin — After Karafuto was ceded to Japan (1905) the Government instituted an enquiry into the agricultural wealth of the island. This investigation, which was terminated in 1910 showed that in the Japanese part of the island there were more than 130 000 hectares (320 000 acres) of land suitable for agriculture and animal husbandry. At present the principal agricultural produce of the island is wheat, barley, oats, rye, peas, colza, potatoes, forage crops and pulse. The report on the still virgin forests of Karafuto yielded the following data :

Total area of forests	3 352 712 chô (1 chô = 2.4507 acres).
Available building timber	1 584 396 429 shakujimé (1 shakujimè = 12 cub ft.).
Conifer forests area	2 104 462 chô.
» available timber	1 385 788 038 shakujimé.
Broad leaved forests area	483 750 chô.
» available timber	53 394 118 shakujimé.
Mixed conifer and broad-leaved forests, area	371 898 c. ô.
Mixed conifer and broad-leaved forests, available timber	145 014 273 shakujimé.
Open woods and deforested areas	392 602 chô.

The most frequent species are: *Abies sachalinensis* Mast., *Picea ajanensis* Fisch. pines, larches, alders (*Alnus incana* L. var hirsta Spach.), *Salix japonica*, *Ulmus campestris*, *Catalpa Kaempferi*, *Populus suaveolens*, etc.

246 - **South African Plant Poisons.** — JURITZ, CHARLES FREDERICK, in *The South African Journal of Science*, Vol. XI, No. 4, pp. 109-143. Kimberley, January 1915. RURAL HYGIENE.

Investigations conducted in the Government Chemical Laboratories at Capetown, Grahamstown and in England, have shown that toxic principles, some of which possess pharmacological possibilities, are contained in the following plants indigenous to the Union of South Africa :

AMARYLLIDACEAE, *Buphane, disticha* Herb, ; *Clivia nobilis* Ldl. ; C. *miniata* Regel ; *Haemanthus natalensis* Pappe ; *H. puniceus* L.

POLYGONACEAE, *Polygonum tomentosum* Willd.
MELIACEAE, *Trichilia Dregei* E. May ; *Melia azedarach* L.
APOCYNACEAE, *Acakanthera venenata* Don ; *Ranwolfia natalensis* Sond.
ASCLEPIADACEAE, *Gomphocarpus* spp.
CYCADACEAE, *Encephalartos* spp.
LILIACEAE, *Bowica volubilis* Harv.
RANUNCULACEAE, *Knowltonia bracleata* Hard.
RUTACEAE, *Xanthoxylon capense* Hard.
EUPHORBIACEAE, *Euphorbia pugniformis* Boiss.
CELASTRACEAE, *Elaeodendron croceum* D. C.
MELIANTHACEAE, *Melianthus comosus* Vahl.
EBENECEAE, *Eucka lanceolata* E. Mey.
COMPOSITAE, *Helichrysum serpillifolium* Less ; *Helichrysum* spp. ; *Dimorphotheca* spp. ; *Diplopappus asper* Less.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

247 - **Experiments on the Changes of the Soil Surface.** — HOFMANN REINHOLD in *Die Landwirtschaftlichen Versuchsstationen*, Vol. LXXXV, Parts I-II, pp. 123-137. Berlin, 1914.

The physical characters of soil depend not only upon the size and form of its component particles but also upon the packing. It is, however, impossible to estimate the latter factor in the case of cultivated land, for it is continually changing owing to tillage, and, further, no exact method has yet been discovered for determining the volume of the spaces existing between the particles. The form and size of the soil particles stand in a definite relation to a third quantity namely the soil surface (*i. e.* the sum of the surfaces of all the solid particles of the soil). This latter, quantity can be expressed numerically using Rodewald and Mitscherlich's method for determining the hygroscopic moisture of soils ; in order to be able to influence the physical composition of the soil and consequently vegetation, the factor must be constant, or subject to such extremely slow changes, as to be negligible. The chief influences to which cultivated soil is subjected are frost and manuring ; therefore the total surface of the soil can only be a determinable factor when the soil is only rarely or never exposed to the action of frost and manure.

The experiments of the writers were directed to ascertaining how far these conditions could be fulfilled and they led to the following conclusions :

1) The action of frost is greatest at the surface of the soil and becomes negligible after freezing has occurred several times.

2) The organic and inorganic manures in the quantities usually adopted in practice produce no considerable or lasting changes.

3) The non-reversible colloids in the soil are reduced by the action of frost and dessication.

248 – **The Evaporation of Water from Soil.** — KEEN, B. A., (Rothamsted Experimental Station), in *The Journal of Agricultural Science*, Vol. VI, Part, 4, pp. 457-475. Cambridge, December 1914.

The relation between soil and evaporation was studied by measuring the rate of evaporation from moist soil maintained at constant temperature over concentrated sulphuric acid. An apparatus was fitted up by means of which it was possible to make successive weighings without removing the evaporating dishes from the sulphuric acid chambers, and thus to reduce very considerably the experimental error.

Two soil fractions, fine sand (0.2-0.04 mm.) and silt (0.04-0.01 mm.), a sample of pure china clay and two soils were used in the experiments, and when the rates of evaporation were plotted, curves were obtained which were continuous over the whole range, showing that there was no abrupt change in the physical state of the water between the limits experimented upon (*i. e.* from about 25 per cent. of water to dryness).

When a tray of moist sand or silt was suspended over sulphuric acid, the rate of evaporation was largely determined by the rate of diffusion of the water vapour from the sand to the acid, and the observed results agreed closely with those calculated from the laws of diffusion. But soil behaved differently, the process of evaporation being so influenced that the comparatively simple laws holding in the case of sand or silt no longer applied. The soluble humus was then removed from a sample of soil by means of a 2 per cent. caustic soda solution, but the soil still behaved as before ; ignition, however, completely altered the character of the evaporation which became precisely similar to the evaporation from sand or silt. Ignition on the other hand did not affect the behaviour of sand or silt, so that the difference between ignited and unignited soil cannot be ascribed to loss of organic matter, but should rather be attributed to the destruction of the colloidal properties of the soil. Further confirmation of this view was obtained by experiments on the china clay sample which possessed only very feeble colloidal properties and yielded an evaporation curve practically identical with that given by fine sand.

Further information on the process of evaporation was obtained by a mathematical examination of the rate curves for soil. Two factors have been distinguished which operate over practically the whole range of water content dealt with in these experiments. In the first place the simple linear relationship observed with sand is not seen with soil, the curve being more nearly exponential in character, and indicating that the relationship of water to soil is quite different from its relationship to sand, a circumstance which has already been traced to the colloids. This relationship has only been expressed empirically, but it is probably connected with the relation between vapour pressure and moisture content. As the curve is not of a simple exponential type another factor must also be at work, *i. e.* the effect or evaporation of the decreasing water surface in the soil, the surface obviously diminishing as evaporation continues.

49 – **The Scouring Lands of Somerset and Warwickshire** (1). — GIMINGHAM, C. T., (University of Bristol) in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 328-336. Cambridge, September 1914.

An area of " teart " or scouring land, similar to that already described in Somerset, has been found in Warwickshire. Here the scouring seems less severe than in the worst cases in Somerset, and is most troublesome in autumn, in mild, damp seasons. Here again the land occurs on the Lower Lias formation, which is nearly free from drift.

As to causes of the phenomena observed, it has been previously shown that neither a bad water supply nor the presence of one or more particular species of plants in " teart " pastures can account for the scouring, whilst, on the other hand, as all attempts to isolate a specific organism have failed and as infection is never carried from a " teart " to a sound field, even when they are only separated by a ditch or when affected cattle are moved from one to the other, it would appear that the possibility of a biological explanation must be excluded.

The Lower Lias soil of the " teart " land has been formed *in situ* and is a characteristic sticky yellowish clay, extremely hard when dry, the subsoil being still stiffer. Chemical examination of the " teart " soils has not revealed anything which could account for the observed effects. In order to investigate further the texture of such soils, determinations of soils density *in situ* were made by means of samples taken with small metal boxes (accurately 2 in. square) having removable tops and bottoms. In all cases the density of the "teart" fields was higher than that of corresponding sound fields. Analysis showed that there was no difference in the ultimate mechanical composition, but that in cases of neighbouring fields the organic matter was higher in those with the least tendency to cause scouring. It therefore seems justifiable to consider the poor physical condition of " teart " soils as a cause of the production of scouring herbage.

As regards the question of how the soil texture can effect the physiological properties of herbage, chemical analysis has failed to reveal any substance to which the scouring properties could be attributed. Herbage from "teart " fields appears to be less mature than herbage from corresponding sound fields ; it is softer and less fibrous ; in seasons when the grass is very lush and grows rapidly, scouring is worst, and such conditions might be expected to accentuate any tendency to produce a somewhat unripe growth.

250 – **Influence of Calcium Carbonate in Neutralising the Injurious Action of Magnesium Carbonate on *Azotobacter chroococcum*.** — LIPMAN, C. B., and BURGESS, P. S., (Agricultural Experiment Station, Berkeley, California) in *The Journal of Agricultural Science*, Vol. VI, Part 4, pp. 484-498. Cambridge, December, 1914.

In connection with the question of the lime-magnesia ratio in soils, it becomes important to study the antagonism displayed by various ions to one another and the protection afforded through such antagonism to the organisms living in the medium concerned.

(1) See also *B.* Nov. 1910, p. 24. (*Ed.*).

Two series of flasks were prepared each containing 50 cc. of Ashby's mannite solution to which had been added amounts varying from 0.1 to 2 per cent. of calcium and magnesium carbonate respectively. The flasks were inoculated with a suspension from a pure culture of *Azotobacter chroococcum* and their nitrogen content was determined after three weeks' incubation. The results obtained are set out in Table I.

TABLE I. — *The effect of calcium carbonate and magnesium carbonate on nitrogen fixation by A. chroococcum in mannite solution.*

Amount of $CaCO_3$ or $MgCO_3$ added	Nitrogen fixed per gram of mannite	
	With $CaCO_3$ added	With $MgCO_3$ added
per cent. of solution	mgms.	mgms.
0	3.36	3.36
0.1	4.97	3.57
0.2	5.53	— 0.35
0.4	6.23	— 0.48
0.6	4.76	— 0.35
0.8	4.75	— 0.28
1.0	5.11	— 0.21
1.2	5.60	1.26
1.4	5.11	— 0.43
1.6	6.09	— 0.28
1.8	5.25	— 0.28
2.0	5.74	— 0.35

The two carbonates had a very different effect on nitrogen fixation. Addition of calcium carbonate proved stimulating in all concentrations, though no increased stimulus was obtained by increasing the dose above 0.4 per cent. Magnesium carbonate on the other hand, was toxic in all concentrations above 0.1 per cent. The magnesium carbonate used answered to the formula $3\ MgCO_3.Mg(OH)_2.3\ H_2O$, and was more alkaline than the calcium carbonate; in order to ascertain whether this could be a factor explaining the different behaviour of the two salts, a mannite solution was brought to the same degree of alkalinity by the addition of about 4 per cent. of $N/_{10}$ caustic potash solution and tested against a control solution; in this case the alkaline solution proved to be the better medium for nitrogen fixation, showing that the toxicity of the magnesium carbonate could not be attributed to its alkalinity.

The various doses of calcium and magnesium carbonate, together with 1 gm. of mannite, were next added to 50 gm. portions of sandy soil which, after sterilization, were inoculated with *Azotobacter chroococcum*. The soil

samples were incubated for four weeks, then analysed for nitrogen content with the results given in Table II.

TABLE II. — *The effect of calcium carbonate and magnesium carbonate on nitrogen fixation in soil.*

Amount of $CaCO_3$ or $MgCO_3$ added	Nitrogen fixed per gram of mannite	
	With $CaCo_3$ added	With $MgCO_3$ added
per cent of soil	mgms.	mgms.
0	6.30	6.30
0.1	5.95	1.75
0.2	5.25	1.40
0.4	4.55	1.75
0.6	5.60	1.05
0.8	4.55	3.85
1.0	7.00	3.15
1.2	6.65	0.35
1.4	2.80	0.35
1.6	1.75	1.05
1.8	1.75	2.80
2.0	2.10	0.70

TABLE III. — *Effect of using both calcium carbonate and magnesium carbonate on nitrogen fixation.*

In 50 cc. mannite solution			In 50 gms. soil		
$MgCO_3$ added	$CaCO_3$ added	Nitrogen fixed per gram of mannite	$MgCO_3$ added	$CaCO_3$ added	Nitrogen fixed per gram of mannite
per cent of sol.	per cent of sol.	mgms.	per cent of soil	per cent of soil	mgms.
0	0	5.39	0	0	5.16
0.2	0	2.03	0.1	0	3.41
0.2	0.25	1.75	0.1	0.25	3.76
0.2	0.50	2.17	0.1	0.50	5.33
0.2	0.75	2.31	0.1	0.75	4.46
0.2	1.00	2.80	0.1	1.00	5.68
0.2	1.25	3.50	0.1	0.25	5.68
0.2	1.50	3.01	0.1	1.50	6.90

The results obtained with the mannite solution were confirmed in a general way. No stimulus was obtained in any case by the addition of carbonates, but while calcium carbonate was non-toxic except when present in concentrations above 1.2 per cent., the magnesium carbonate was toxic even in the smallest concentration.

The experiments were then repeated using the two salts together in order to determine the neutralising effect, if any, of the one on the other. The results are given in Table III.

Both in the mannite solution and in the soil the toxic effect of magnesium carbonate as mesured by the activity of *A. chroococcum* was distinctly counteracted and neutralized by increasing doses of calcium carbonate.

MANURES AND MANURING.

251 – **Comparison of Silicates and Carbonates as Sources of Lime and Magnesia for Plants.** — Mac Intire, W. H., and Willis, L. G., in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 12, pp. 1005-1008. Easton, Pa., December 1914.

Previous methods for the determination of carbonates in soils often give results showing the presence of carbonates in soils which are found to possess a lime requirement by the Veitch method. In many cases, all the carbon dioxide found when soils were boiled with acid has been erroneously considered as in combination with lime, while the lime has occurred largely in the form of silicates and not as carbonates. Soils rich in silicates of calcium and magnesium, but devoid of carbonates, will give an alkaline reaction towards litmus paper. Litmus paper therefore only indicates acidity in the absence of carbonates when there is no considerable amount of alkaline earth silicates.

The long continued effects of liming in small or moderate amounts are to be attributed, not to a continuation of the occurrence of carbonates, but to the conservation of lime as silicates. Through hydrolysis calcium silicate functions in the same manner as calcium carbonate furnishing lime as bicarbonate to the soil solution. Calcium often occurs in soils almost entirely as phosphates and silicates, while magnesia seldom exists as the carbonate but generally as the silicate (1).

A series of pot culture experiments was carried out with clover in a sandy clay loam and a silty loam each having a lime requirement of about 1 ton of calcium carbonate per 3 500 000 lbs. of soil. Lime and magnesia as precipitated carbonates and as ground mineral silicates (wollastonite and serpentine) passing through a 100-mesh sieve were applied separately in amounts chemically equivalent to 16 070 lbs. of calcium carbonate per 3 500 000 lbs. of soil in excess of the indication of the Veitch method.

The results obtained are given in the adjoining table :

These results show that while harmful results may be expected from excessive amounts of lime as finely divided carbonates, the same may not be said of lime in the form of silicates. In one soil the mixture of the two silicates increased the growth above that obtained from either silicate alone, while the substitution of calcium carbonate for calcium silicate as supple-

(1 See *B.* Feb. 1915, No. 1 9.

Growth of red clover in grams, air dry weight.
Total of two pots for each treatment for each soil.

	A $MgSiO_3$ (Serpentine)	B $MgSiO_3$ and $CaSiO_3$	C $MgSiO_3$ and $CaCO_3$	D $CaSiO_3$ (Wollastonite)	E $CaCO_3$ (precipitated)	F $MgCO_3$ (precipitated)
Sandy clay loam						
No. of plants	27	47	26	20	21	1
Weight of plants. . .	11.4813	12.2757	1.8889	13.8557	4.8917	0.0165
Silty loam						
No. of plants	14	30	30	9	5	0
Weight of plants. . .	1.3427	4.1743	0.1361	0.5892	0.0642	0.0000

mentary to magnesium silicate was decidedly disadvantageous. There is every indication that calcium silicate is decidedly superior to calcium carbonate both in its effect upon plant growth and as a form tending to conserve lime in soils.

252 – **Kalusz Kainit.** — KOLSKI WINCENTY, in *Zeitschrift für das Landwirtschaftliche Versuchswesen*, Year XVIII, Part 12, pp. 892-901. December 1914.

Near Kalusz (in East Galicia) there are large deposits of potassic salts. In 1853, or 1854 it was observed that in addition to the rock-salt, that has been extracted from these mines since the middle of the fifteenth century, there was another salt which was identified seven years later as sylvine. The industry of its extraction seems to have begun about 1869. Some years later, the State transferred to the Agrarian Council of Galicia the right of working the potash deposits of Kalusz. Finally in 1914, a joint stock company was formed which acquired the right of working the potash deposits in Kalusz and on 3000 square kilometers (1057 square miles) in the surrounding district. The manufacture of concentrated potash salts has already begun, and recently very thick deposits of sylvine have been discovered.

The salt deposits of Kalusz are situated on the north east slopes of the Carpathians heights formed of sandstone which run from south east to north west and belong to the Jurassic and Cretaceous formations. Beneath a covering layer of loam, of gypsum and of clay, two strata are found; the lower consisting of clay with occasional layers of anhydrite, but without potassium, and the upper also composed chiefly of clay, but with intercalated thick layers of rock-salt, sylvine and kainit. Hitherto there have been found at a depth of 246 and 420 feet respectively, two rich deposits of kainit about 16 ft. thick; these layers are mixed with rock salt and clay, the amount of pure kainit being about 60 per cent. Sylvine is found more abundantly in three places at a depth of from 777 to 820 feet. One of the layers is 33 ft. thick and contains about 39 per cent of potassium chloride, another is 41 ft. thick, contains 42 per cent of the same chloride, and is

completely free from magnesium salts. The amounts of kainit extracted at Kalusz fluctuated very much, varying from nothing (between 1875 and 1886) to 29 920 tons (in 1873). The average annual extraction during the last ten years has been 15 744 tons; most of the Kalusz kainit contains from 9 to 11 per cent of potash (K_2O), the average amount being a little more than 10.

The average chlorine content of the above kainit is 29 per cent. As a rule, a high chlorine content corresponds with a low potash percentage. A low chlorine content is an advantage as when present beyond certain limits, this element is injurious to many cultivated plants; the Kalusz kainits seem, in general, to contain less chlorine than those of Stassfurt. Their average content of sulphuric anhydrid is 17.5 per cent; this increases or decreases with the potash. The percentage of sodium oxide in the same analyses was most variable — from 8 to 20 per cent. One sample contained 0.65 per cent of manganous-manganic oxide.

253 – **New Suggestions for the Utilisation of Leucites as a Potash Fertiliser.** — Lucchelli, U., in *L'Agricoltura Moderna*, Year XXI, No. 1, pp. 9-11. Milan, January, 1915.

The writer deals with a very recent and patented process by which potassic minerals in general, and leucites in particular, are subjected to an alkaline treatment (recourse being specially had to potassium sulphate) with the view of increasing the alkalinity and solubility of the mineral compound. The best results were obtained with a mixture formed of 4 parts of ground leucite, 4 parts of potassium sulphate and 2 parts of powdered calcium carbonate. The mixture is placed in kilns similar to those used for firing stone-ware or quick-setting cements; a whitish porous mass is thus obtained that is friable and very easily reduced to the finest powder. This contains the alkalis almost entirely in the form of soluble silicates, while the lime is turned into a sulphate.

In this mixture the potassium becomes less soluble than in the potash salts of Stassfurt, and hence is less easily carried away by rain water; then there are present other useful elements, in a form easily assimilated such as, soda, gypsum, aluminium phosphates, soluble silicate, etc.

From the economic point of view, valuing leucite at $7\frac{1}{4}d$ per cwt., 50 per cent potassium sulphate at 10*s* 1*d* per cwt., calcium carbonate in pieces at $4\frac{3}{4}d$ per cwt., 1 cwt. of raw material costs 4*s* 4*d*. Calculating the cost of grinding, firing and grinding again at $9\frac{3}{4}d$, the cost of 1 cwt. of the resulting product containing 32.3 lbs. of potassium is 5*s* $1\frac{3}{4}d$. per cwt.

As regards the sale, the writer considers that the estimated price of the potassium may rise to 2.37*d* per lb. seeing the greater alkalinity of the compound and its greater uniformity in diffusion, in comparison with other potash salts. He further values the soda at 10*s* per cwt. and the calcium sulphate at 10*d* per cwt. making the total sale price 6*s* $8\frac{1}{2}d$ per cwt.

254 – **Observations upon the Value of the Principal Nitrogenous Fertilizers.** — (Institu für Boden und Pflanzenbaulehre zu Bonn Poppelsdorf) OSWALD, S., and WEBER, W. (with the collaboration of Prof. TH. REMY) in *Landwirtschafliche Jahrbücher*, Vol. XLVII Part 1, pp. 79-160. Berlin, 1914.

It is of great practical importance to know if any constant relation actually exists between the values of the different kinds of nitrogenous fertilizers from the point of view of their efficiency.

The writers begin by stating that, taking the increase of production obtained with nitrate of soda as 100, the corresponding increase (which should represent the relative value) in the cases of sulphate of ammonia, calcium cyanamide and dried blood are very different in the experiments of different writers. Nor can it be otherwise, seeing such increases depend upon the plants manured, upon the season, the nature of the soil etc. Further the investigations did not always take into account the unexhausted manures left in the ground from preceding crops, and this omission leads to vary perceptible errors, since in three years the effect of the chief nitrogenous fertilisers is distributed as follows:

	1st year	2nd year	3rd year
Nitrate of soda	90	10	0
Sulphate of ammonia	70	20	10
Proteid nitrogen	50	30	20

It was therefore necessary to attack the problem by means of experiments of longer duration, *i. e.* lasting for at least three years, and to estimate the amount of unexhausted manures left in the ground, at least during two years. All this the writers did in the experiments they carried out at Poppelsdorf and Vilich from 1907-1913. Table I gives the amounts of fertilizers used.

TABLE I. — *Amounts of fertilizers used (lbs. per acre).*

Fertilisers	Sugar beets	Oats	Potatoes	Peas	Rye	Fertiliser used in 5 years	Amount removed (approximative) in 5 years
Organic fertilisers	Crimson clover as green manure 1910, 1911, 1913	—	green manure in 1913	—	—	—	—
Nitrogen	53.5	26.8*	26.8	—	—**	107	535
Potash	107	107	107	107	107	535	535
P_2O_5 (superphosphate) . .	53.5	53.5	53.5	53.5	53.5	267.6	223
Quicklime	—	—	—	2 230	—	2 230	267.6
Magnesia	1 605	—	—	—	—	1 605	—

(*) In 1913, only 13.4 lbs.
(**) 26.8 lbs. only in 1907 and 1908; in 1913, 13.4 lbs.

The potash was administered in the form of kainit, and only in the case of the potatoes in the form of 40 per cent potash salts. The average results in lbs. per acre are given in the table II. The averages refer to the seven years 1907-1913 in the case of the sugar beets, to the six years, 1907 and 1909-1913, in that of the other crops. It is noteworthy that the pea crops were small owing to the attacks of parasites.

TABLE II. — *Crop yields (lbs. per acre).*

Crops	Without nitrogen	Nitrate of soda	Sulphate of ammonia	Dried blood	Calcium cyanamide
Sugar beets:					
roots	26 492	33 718	33 450	34 253	32 826
tops	23 727	33 896	29 258	32 380	32 023
sugar	4 487	5 673	5 878	5 869	5 789
Potatoes:					
tubers	17 840	20 248	20 338	20 873	21 051
starch	2 810	3 372	3 300	3 318	3 479
Oats: weight of air-dried sheaves	5 887	8 742	7 583	7 850	7 760
Rye: weight of air-dried sheaves	8 233	9 366	8 911	8 866	9 428
Peas: whole air-dried plant	3 987	4 415	4 487	3 594	4 594
Increase in production (average of 5 years compared with plots without nitrogen).					
Sugar beets:					
sugar	—	1 168	1 391	1 356	1 311
leaves	—	10 080	5 530	8 652	8 385
Oats: straw and panicles	—	2 854	1 695	1 962	1 873
Potatoes: starch	—	553	482	499	660
Peas: whole plant	—	446	535	624	624
Rye: straw and ears	—	1 060	714	625	1 160
		£ s d	£ s d	£ s d	£ s d
Value of increased production in 5 years	—	15 0 1	12 5 2	13 2 8	14 6 9
Price of nitrogen applied	—	3 14 10	3 10 7	4 13 8	2 19 10
Value of the increased crops after deducting the cost of the nitrogen	—	11 5 3	8 14 7	8 9 0	11 6 11

From the results they obtained, the writers conclude that it is impossible to express by numbers which will hold good in every case, the efficiency

of the different nitrogenous fertilisers since this changes according to th circumstances under which they are applied. The numerous experiment which have hitherto been made prove, however, without any doubt tha nitrate of soda has a certain superiority owing to the facts that it i capable of being directly assimilated and is almost entirely used in th first year. In the experiments of the writers, when the unexhausted amoun of the fertiliser in the soil was taken into account, almost equal value were obtained for the different nitrogenous fertilisers used. It is espe cially noteworthy that at Vilich where the soil is very light, sulphate o ammonia proved equal to nitrate of soda; Haselhoff had obtained th same result already with his pot experiments.

Calcium cyanamide showed itself equal to nitrate of soda both i the cases of sugar beets and potatoes. Naturally it is necessary to tak into consideration the slower action of calcium cyanamide and arrang that the nitrogenous fertiliser shall take effect at the opportune momen therefore if the manure is required to act quickly, some nitrate of sod should be applied at the same time as the calcium cyanamide. Such mixture suits sugar-beets and mangolds very well.

255 – **The Action of Some Catalytic Elements in the Soil.** — I. LEONCINI, G., (I fluenza di alcuni composti ossigenati di manganese nella nitrificazione). — MUNERATI, O MEZZADROLI, G., and ZAPPAROLI, T. V., (Elementi catalitici e sostanze fertilizzan poco usate nella cultura della barbabietola da zucchero), in *Le stazioni sperimenta agrarie italiane*, Vol. XLVII, Parts 11-12, pp. 777-801 and 817-852. Modena, 1914.

I. The experiments of the writer only deal with the behaviour o substances which, like the compounds of manganese, have the propert of parting with their own oxygen and then reoxidizing again thus acting a oxidising catalisers, and his researches were directed to ascertaining whe ther manganese dioxide actually has a favourable influence on nitrif cation. Two series of experiments were made; in the first, there wa added to the soils, or solutions, in which the course of denitrification wa studied, a relatively large amount of manganese dioxide; in the second the proportions of dioxide varied from very low to higher percentages, bu were always less than those used in the first series. Moreover, while i the latter the dioxide was only regarded as a substance that readily part with oxygen, in the former, it was looked upon, not only from this poin of view, but also as a catalising substance promoting nitrification.

In the first series the manganese dioxide, in the form of a very fin powder, was mixed with soil the whole being afterwards watered with solution of ammonium sulphate. The natural colloidal manganese hydrat (known as "wad") was also employed.

The results obtained led to the conclusions that, in a soil devoid o vegetation, neither the dioxide nor the hydrate can excercise a favourabl effect upon nitrification; on the contrary, it could be observed that the use had rather an obstructive action which by other experimenters wa recognised as due to the action of the ions of manganese on higher plants.

The second series of experiments was also carried out on bare ground with the result that the manganese dioxide, which was mixed in ver

large quantities with the soil, not only did not promote nitrification, but seemed rather to hinder it, and instead, to promote denitrification. In the same way, small amounts of dioxide do not encourage nitrification, in fact they are without effect. When, on the other hand, the dioxide is added in suitable amounts (about 2 ½ to 4 cwt. per acre) very noteworthy results are obtained, since the largest quantity of nitric nitrogen is met with in soils to which the dioxide has been added. The same conclusions hold good also for wad. " If one considers " says the writer, " that the free access, of the oxygen of the air to the soil has as good results if not better, than the dioxide, as regards nitrification, it remains doubtful whether the use of a catalytic fertiliser would be of any real value, at least, from the point of view of its effect upon nitrification ".

II. In 1914, the writers undertook the study of the influence of the so-called catalytic substances — especially salts of manganese — upon the production and industrial value of sugar beets. They experimented at the same time with other fertilizing substances still but little used in agriculture such as : magnesium salts, sulphur and its compounds (precipitated sulphur, common sulphur, pyrites, agricultural gypsum), nitrate of lead and nitrate of uranyl. The comparisons were made on plots and with a basal phosphatic fertiliser, the various above-mentioned substances being combined in different ways, both as regards quality and quantity.

The results of these numerous experiments was a uniform want of success notwithstanding that the plant used was one very susceptible to catalysers and to the influence of the less frequently used nutritive elements.

The writers, in short, consider that applications of salts of manganese are efficient only in the infrequent cases where the element is deficient, or when an artificial medium is used.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

256 – **The Enzymes of *Aspergillus terricola*.** — SCALES, F. M., (U. S. Department of Agriculture, Washington, D. C.), in *The Journal of Biological Chemistry*, Vol. XIX, No 4, pp. 459-472. Baltimore Md., December 1914.

These researches were undertaken to determine the functions of the enzymes of a fungus of the terricola type, such as *Aspergillus terricola*, and to determine its importance under favourable conditions, in the production of nutritive substances for the flora of the soil. The fungus was obtained in the red soils of Roma, Georgia, and cultivated artificially. It was then washed, dried and pulverised and subjected to the " Acetondauerhefe " method for the separation of the enzymes. An examination of the growth of the fungus in various media and of the activity of the enzymes produced, led to the following conclusions :

The fungus produced inulase, diastase, invertase, maltase, alcohol-oxydase, emulsin, lipase, protease and amidase when cultivated in a medium not containing these enzymes. Thus, considering the number of enzymes produced, it is obvious that the hyphomycetes and also bacteria are able to make use of the different products of organic decompotition which have been isolated from the soil. Many products of the enzymic action are

excellent sources of carbon and nitrogen for bacteria. Ammonia produced from certain albuminoid substances in the fungus, can, in the form of salts, be directly assimilated by certain plants. The living organism is able to hydrolyse a small quantity of cellulose in an agar culture containing cellulose, but the presence of cellulase cannot b detected amongst the enzymes in powder form. Neither lactase nor zymase was found in the powder of *A. terricola* after growing respectively in solutions of lactose and glucose. Tannase was produced by the fungus which had grown in a solution of tannin. The fungus was not able to fix nitrogen when grown in culture solution containing either carbohydrates (dextrose or mannite) or nitrogenous substances (peptone or ammonium sulphate), or both together.

257 – **The Relation Between the Number of Vascular Bundles in Cereals and Resistance to Lodging.** — MOLDENHAVER, K., (Aus dem landw. Institut für Pflanzenbau der Landw. Akademie Dublany), in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesierreich*, Year XVII, Part 12, pp. 886-891. Vienna, December 1914.

The writer has studied anatomically and statistically the number of vascular bundles in 19 different foreign and native varieties of *Triticum vulgare* cultivated by him at Dublany, Galicia. He examined microscopically from 200 to 250 sections of each of the varieties studied and devoted special attention to the internal vascular tissue embedded in the parenchyma which seems of much greater importance to the plant than the fibres outside the sclerenchymous ring. From the results of this examination, the varieties are divided into three groups. The first includes five varieties, Loodsdorfer Bartweizen Rp. Dublany, the winter wheats Schampaner, Donka, Ochrymowiecker, and Loodsdorfer Kreuzweizen Rp. Dublany, which are distinguished by the limited number of both internal and external vascular bundles. They belong for the most part to continental climates and are all bearded ; their straw is thin and long and their cars are elongated and narrow. These varieties are all resistant to cold and are very hardy as regards climate, differing in these respects from the wheats of the third group. The latter are winter wheats (Prof. Wohltmann, Gross-fürst von Sachsen, Buhlendorfer Rp. Dublany, Crievner 104, Tewerson, Konstancia) and belong the to Square-head type. Their straw is rigid and thick and their behaviour is essentially different from that of the members of the first group, with the exception of Gross-fürst von Sachsen which belongs to the bearded Square-head type.

The second group contains both bearded and unbearded varieties ; they are mostly local winter kinds: Bearded Galicia, Inversable, Bearded Lopuska, Sandomierka, Eckendorfer Rp. Dublany, Lozincka, Beardless Mikulice, Niemiercze Banater.

The number of vascular bundles is clearly characteristic for each group ; it oscillates between 23.42 $\pm$ 0.381 and 26.37 $\pm$ 0.462 for the first group ; between 28.36 $\pm$ 0.424 and 32.84 $\pm$ 0.382 for the second ; and between 34.18 $\pm$ 0.321 and 38.51 $\pm$ 0.385 for the third. The lowest value belongs to the first of the varieties given in each group, the highest to the last. The varieties are placed in ascending order, as regards the number of the bundles.

Since all the wheats had been grown in the same district, and under absolutely similar conditions, it was impossible that the variation in the number of bundles should be due to external causes. The Tewerson and Konstancia wheats which have the larger number of bundles remained standing longer than the others, viz. until harvest, while the varieties of the first group were almost completely lodged immediately after flowering. This is explained by the fact that each vascular bundle is surrounded by a sheath of sclerenchyma which serves to give mechanical support to the bundle itself. With the increase in the number of bundles the general number of sclerenchyma fibres increases, thus the haulm acquires a much greater mechanical resistance, especially against lodging.

The number of the vascular bundles seems to follow Mendel's law, but there are still very few data respecting this subject; the writers are studying the heredity of this character in the hybrids Square head × *Triticum Spelta Duchamelianum*.

Conclusions, — (1) The number of vascular bundles is characteristic for each variety and in some cases can serve as a distinguishing character.

(2) The continental varieties of wheat have a much smaller number of vascular bundles than those growing near the sea such as for instance the Square-head type.

(3) Pure lines of barley which are distinguished by different morphological characters are very clearly recognized by the number of their vascular bundles.

(4) The rigidity of the haulms of the cereals which is the cause of their resistance to lodging depends largely upon the number of the vascular bundles.

258 – **Correlation between the Internodes of a Haulm. Investigation of the Structure of Haulms in Connection with the Production of Strains Resistant to Lodging.** — PLAHN - APPIANI, H., in *Zeitschrift für Pflanzenzüchtung*, Vol. II, No. 4, pp. 461-494. Berlin, November 1914.

A series of investigations were carried out on rye to determine the structure of the haulm and the correlation between its different internodes as factors in the plant's resistance to lodging Holdefleiss's apparatus (as modified by Mensing) was used for measuring the resistance to breaking force of the straw. After discussing the results obtained, the writer draws the following conclusions:

1. The "positive solidity" of an internode in a haulm may be defined as the minimum weight required to break the straw when applied to a length x which is calculated from the formula

$$x = \sqrt{a^2 + \tfrac{1}{4}\, a^2} - \tfrac{1}{2}\, a$$

where a = the actual length of the internode.

2. In normal plants, the positive solidity of the internodes diminishes gradually from the base to the apex of the haulms.

3. The positive solidity cannot be used as a basis for selection in plant breeding because it is controlled by external factors during the various periods of vegetation which thus completely mask all hereditary tendencies.

259 - **The Flowering of Rice and Some Attendant Circumstances.** — AKEMINE, M., *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 3, pp. 339-375 + 6 figg. Berlin, 1914.

An account is given of the results of 6 years' investigations carried out by the writer at Sapporo, on the "Akage" rice which is the most common variety grown in the coldest parts of Japan. The investigations refer to the development of the flowers; the morphological modifications of the floral organs during flowering; the influence of surroundings upon flowering; the relation between the period of blossoming and the weight of the grain; pollination; the effect of rain upon fertilisation ; cross-fertilization, etc.

Some of the principal results were as follows:

All the floral organs of the rice plant, with the exception of the pistil, reach their highest development about 5 days before opening. The rice plant has normally chasmogamous (open) flowers, but sometimes, under unfavourable conditions, it forms cleistogamous flowers. At the flowering time, the glumes form an angle of about 30°, under normal conditions they remain open from 1 ½ to 2 ½ hours ; at low temperatures and on damp days, the time of their expansion is somewhat longer. About 4 days after closing the glumes interlock with each other and are completely joined in about 7 days. The glumes close thus, even if pollination has not taken place; in such a case, however, they do not interlock.

The opening of the flower is brought about by the swelling of the lodicules, which become about three times their former thickness, while the staminal filaments become about five times their original length but do not thicken. The pistil, on the contrary, undergoes no notable changes, the style merely expanding laterally. Under normal conditions, the expansion of the flowers begins towards 9 a. m. or midday, and finishes about 3 p. m. The duration of the flowering is briefer, if the external conditions are favourable, while they are longer if the latter are unfavourable. The minimum temperature required for the opening of the flowers is about 15° C., the maximum is from 35°-40° C.; the higher the natural temperature, the more active the process, and during flowering, the highest temperature which is not injurious to the plant is about 50° C. Light has no effect on flowering; when the temperature is sufficiently high, it takes place about normally even in the presence of great humidity.

As a rule, the flowers that open first form the heaviest caryopses, and those that open last give rise to the lightest. Pollination takes place, either immediately before or at the moment of the opening of the flower ; rice is thus essentielly autogamous. Under favourable conditions, fertilisation commences about 12 hours after the flowering and is complete after about one day. The opening of the glumes offers no absolute physiological advantage, since the fruits can form equally well when the former are constricted and remain closed. The unfavourable effect of rain is perhaps only to be attribuited to its mechanical action on the anthers which sometimes

do not assume their normal position and thus interfere with pollination. Low temperatures greatly hinder the development of the pollen-tube and fertilization, even if the stigma has been well covered with pollen.

Cross-fertilization can often occur in rice, if the anthers do not assume their normal position, either on account of incomplete development, or of unsuitable surrounding conditions. The fertilised ovaries bend back in about one day towards the internal glumes, then they grow continually until they reach the apices of the glumes. The portion of the fruit which is the last to form is always that situated a little above the embryo.

260 – **The Analysis of Tomatoes.** — BRAUTLECHT, C. A., and CRAWFORD, G., in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 12, pp. 1001-1002. Easton, Pa., December 1914.

There appears to be general agreement that the tomato plant uses relatively little phosphoric acid, but more potash and nitrogen. Most of the potash remains in the vines and roots so that the crop removes very little mineral matter from the soil. During ripening there is a progressive increase in the organic acids, sugars, starch and non-protein nitrogen and a decrease in protein nitrogen and cellulose. The proportion of other constituents remains practically unchanged.

Analysis of tomatoes from ten counties in Florida showed the following variations per cent : 89.3 to 95.3 per cent of water ; 0.38 to 0.64 per cent of ash ; 1.53 to 7.78 per cent of iron in ash. The amount of iron calculated on the fresh fruit varies from 0.012 to 0.037 per cent and averages 0.023 per cent.

The soil in which these tomatoes were grown contained from 1.06 to 1.3 per cent of iron.

261 – **The Calciphobe Character of the Lupin.** — PFEIFFER, TH., and BLANCK, E., in *Mitteilungen der Landwirtschaftlichen Institute der Königlichen Universität Breslau*, Vol. VIII, Part II, pp. 201-233. Berlin 1914.

In a previous article (1) the writers put forward the hypothesis that the calciphobe character manifested by lupins was attributable to two causes : 1) that the availability of a very large amount of lime might result in its excessive absorption by the plant and act unfavourably upon the metabolism of the latter either indirectly by hindering the absorption of other and indispensable substances, or directly by poisoning the plant. To this result the writers give the name of " general action of calcium ". 2) That the lupin which is able to grow in poor soil possesses in its roots a great property of dissolving the insoluble constituents of the soil. When it finds itself in the presence of large quantities of the carbonates of the alkaline earths, it is under conditions to which it is not adapted and these produce disturbances in the plant's development. This specific effect is termed by the writers " the action of the carbonate ".

It was not possible as a result of previous investigations to give a complete explanation of the lupin's calciphobe behaviour, it was shown,

(1) See *B.* Feb. 1911, No. 388. (*Ed.*).

however, that the yellow variety is very susceptible to alkalis and that its aversion to calcium must be attributed, at least in part, to the action of the carbonate which causes the neutralisation of the acids of the roots. It is a question here, not only of an indirect effect, viz. the diminution of the solvent property of the roots, but also of the direct injurious effect of an alkaline nutritive substratum. Given, however, the contradictory results obtained by previous investigators, as well as by the writers themselves it has been impossible to ascribe the injurious effect of the lime to any single factor. A further study of the question during the three years 1911-1913, led to the following conclusions:

1) Crushed limestone acts less unfavourably upon the development of the lupin than precipitated lime or chalk, hence the harm done by these latter substances cannot be compared to the injurious effects observed in the field under natural conditions. The series of experiments made, shows great differences in the action of the limestone, so that it is impossible to determine the point at which the injurious effect begins. The fact that in one case the limestone caused a greater production of dry matter cannot be explained. The amount of limestone given to the lupins had a favourable action upon peas.

2) Gypsum also had an injurious effect upon lupins, although the amount of lime absorbed by them from this substance was less than in the case of limestone. This last fact is noteworthy, seeing the greater solubility of gypsum in water containing carbonic acid, and shows that salts of organic acids capable of being absorbed are more easily produced from limestone, by the activity of the roots. The injurious effect of gypsum and the greater amount of calcium absorbed from limestone renders it probable that the susceptibility of *Lupinus* to lime is partly due to the " general action of lime ", *i. e.* to an excess of available carbonate.

3) This last conclusion might also be deduced from the injurious effect of the addition of nitrate of calcium to carbonate of calcium. But since nitrate of potassium had the same effect as nitrate of calcium, the toxic action must be chiefly due to the physiologically alkaline reaction of the nitrates.

4) Ammonium suplhate, which is physiologically acid, only had an appreciable injurious action upon lupins when it was given in very large quantities.

5) The formation of root tubercles in lupins was affected when the growth of the plants was hindered by the limestone etc., and this retarded development was accompanied by a decrease in the absorption of nitrogen. Nevertheless, the calciphobe properties of the lupin could not be due to lack of nitrogen as the bad effects not only did not cease in the presence of nitrates, but were even intensified when nitrate of lime was added to carbonate of lime. It is thus a question of a general injury to the plant accompanied by a decreased formation of the root tubercles. In this case too the peas behaved in a contrary manner to the lupins.

6) The lupins' content of phosphoric acid is notably decreased by the effect of limestone and nitrate ; this diminution is less in the case of

gypsum and is absent when ammonium sulphate is used. Hence it would seem possible that the idiosyncrasy manifested by the lupins might partially be ascribed to want of phosphorus, but this hypothesis is contradicted by the fact that in the writers' experiments the plants were manured with a fertilizer containing usually a high percentage of phosphorus. In addition to the carbonate of calcium, the peas absorbed one year a little more and one year a little less phosphoric acid ; these plants always behaved quite differently to the lupins.

7) It was never proved by the researches of the writers that the reason of the lupin's aversion to lime was due to a deficiency in potash; further, this peculiarity on the part of the plant was not decreased when it was supplied with a large amount of easily soluble potassic compounds.

8) The absorption of iron by some of the lupins sensibly decreased on their being supplied with carbonate of lime, nitrate of lime and nitrate of potassium, on the other hand, ammonium sulphate, as a physiologically acid salt, had a somewhat limited, but favourable, effect upon the absorption of the above-mentioned element.

It may therefore be safely admitted in agreement with other writers, that the calciphobe properties exhibited by lupins are, to some extent, attributable to the decreased absorption of iron. Also in this respect, peas act differently to lupins. The addition of carbonate of lime does not diminish to any appreciable extent the absorption of iron by the peas, thus the activity of their roots is less affected than lupin roots by these calcium salts. This again shows that the latter plants have a special susceptibility to substances that combine with acids.

9) In conclusion, the aversion shown to lime by lupins is a most complicated phenomenon, due undoubtedly to several factors.

The experiments will be continued.

262 – **The Action of Alkalis and Acids on the Permeability of Protoplasm.** — OSTERHAUT, W. J. V. (Harvard University) in *The Journal of Biological Chemistry*, Vol. XIX, No. 3, pp. 335-343; No. 4, pp. 493-301. Baltimore, Md., November and December 1914.

Warburg has shown that sodium hydrate causes a considerable increase in the oxidation of fertilised eggs of the sea-urchin, but that the alkali does not penetrate into the interior of the egg. Further, Harvey has found that sodium hydrate does not easily penetrate into the cells of *Elodea*, *Spirogyra* and *Paramœcium*. It then becomes necessary to explain the influence of caustic soda on oxidation, if its action is confined to the cell wall. It is possible that oxidation takes place especially on the surface of the cell or that the caustic soda influences the oxidation by increasing the permeability of the cell to oxygen and other substances. In order to test this hypothesis the writer makes use of a method already described by him (*Science*, XXXV, p. 192, 1912). It consists in the determination of the electrical resistance of the living tissues of *Laminaria saccharina* immersed in sea-water to which has been added variable quantities of an aqueous solution of caustic soda having the same electrical conductivity as the sea-water, or a mixture of sodium and calcium chloride, or even of sodium

chloride and calcium hydrate. It was found that a very small quantity of soda was sufficient to produce a considerable increase in permeability.

The same method was applied to the study of the effect of acids and it was found that whilst alkali causes a simple increase of permeability, acids produce a rapid decrease, followed immediately by a rapid increase which continues to the fatal point.

263 – **The Antagonism Between Acids and Salts in the Plant Cell.** — OSTEREOUT, W. J. V. in *The Journal of Biological Chemistry*, Vol. XIX, No. 4, pp. 517-520. Baltimore, Md., December 1914.

In his work on animal physiology Loeb has demonstrated that the action of acids is antagonistic to that of salts and has pointed out that this fact is of special importance to the theory of permeability, since it indicates that the permeability of the protoplasmic membrane to water and to substances soluble in water depends upon the presence of proteids rather than on that of lipoids.

The writer's investigations have proved that a similar antagonism exists in plants, although in this case it is less pronounced. This shows the proteid nature of the protoplasmic membrane of plants and agrees with the fact that (as demonstrated by the writer) ions pass through this protoplasmic membrane which they would be unable to do if the latter were composed of lipoids.

The method used in these investigations consisted in determining the electric conductivity of *Laminaria saccharina* which gives the exact measure of the permeability of protoplasm. A solution of hydrocloric acid of the same conductivity as sea water was prepared; different quantities of this were added to a solution of sodium chloride, having also the same conductivity as sea water ; the electric resistance of living fragments of *Laminaria saccharina* was determined after they had remained for various lengths of time in the different mixed solutions, as well as in solutions of pure sodium chloride and pure hydrochloric acid.

From the results set forth in tables and diagrams, the writer concludes as follows : The action of sodium chloride may be antagonised by that of hydrochloric acid. The degree of the antagonism is not so great as that existing between sodium chloride and calcium chloride. Life cannot be prolonged as long in the most favourable mixtures of sodium chloride and hydrochloric acid as in the most favourable mixtures of sodium chloride and calcium chloride. The results show that the protoplasmic membrane of plants is of a proteid nature.

264 – **The Antagonism between Ions in the Absorption of Salts by Plants.** — STILES, W., and JÖRGENSEN, INGVAR, (Leeds University) in *The New Phytologist*, Vol. XIII, No. 8, pp. 253-268. London, October, 1914.

From a brief survey of the work published on antagonism it is evident that this is a phenomenon of widespread or perhaps universal occurrence in organic life, as it has been observed in connection with absorption by both animals and plants, and in the case of the latter, in species from all parts of the plant kingdom.

Antagonism appears to be limited to kations (1), but not merely to those which are generally supposed to have a nutritive value or which are present in the plant; Szücs' researches have shown that it exists also between such unnecessary or poisonous ions as aluminium and copper, and even between metals and alkaloid bases. The cases of antagonism that have been observed so far appear to show that this effect is greatest between ions of a different valency, but it is not altogether absent between ions of the same valency.

The most plausible explanation of antagonism that has been put forward is certainly that of Szücs which is itself based on Pauli's view of absorption. Pauli regards the plasma-membrane as acting as a carrier of ions into the interior of the cell. The plasma -membrane is supposed to form compounds with the ions and by the reversibility of the process the ions enter the cell. Szücs points out that on this view it is possible to understand how it is that inorganic electrolytes which play so important a part in plant nutrition, but which on the other hand are insoluble in lipoids (2), are able to enter the cell.

Szücs concludes that according to Pauli's view, if there is outside the cell a mixture of salts containing two different ions, both of which are carried in by the same radicle of the plasma-membrane, these ions must naturally hinder one another's absorption ; each will combine with a part of the plasma membrane substance which would otherwise be used by the other ion if that alone were present, and so the absorption of both ions is hindered.

Whereas it has been generally supposed that the seat of antagonistic ion action is the plasma-membrane, Hansteen-Cranner in a recent paper, puts forward the opinion that the cell wall plays an active part in the interchange of substances between the living cell and its surrounding. This author produces evidence to show that the cell wall of actively growing cells contains lipoid substances as well as cellulose and pectin, and that the cell wall must be considered as of much greater importance in the vital functions of the cell than has hitherto been supposed. It must be left for future work to localise definitely the actual part which the various membranes surrounding the protoplast actually play in the phenomenon of antagonism.

265 – **The Physiological Action of the Salts of Aluminium upon Plants.** — KRATZMANN, ERNST, (k. k. Hochschule für Bodenkultur in Wien) in *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften, mathematische-naturwissenschaftliche Klasse*, Vol. CXXIII, Parts II and III, pp. 211-233. Vienna, 1914.

The writer gives a critical review of the experiments made by others and describes those carried out by himself respecting the effect of aluminium

(1) An antagonism between anions has recently been recorded by Miyake. (*Auth.*).

(2) It should be noted that the theory of Quincke and Overton to the effect that the plasma-membrane is of the nature of a continuous film of lipoid, is by no means generally accepted, although most workers are agreed as to the presence of lipoid in the plasma-membrane. Czapek for instance suggests that the fatty substance might simply be suspended as an emulsion in a colloidal complex of water and proteid; this would enable one to understand the intake of substances like salts which are insoluble in lipoid, but soluble in water. (*Auth.*).

upon the colour of plants, or portions of plants, containing anthocyanin, and upon starch formation and plasmolysis. He also gives an account of his investigations regarding the poisonous action of aluminium salts, their effect upon the development of fungi (the cultural experiment of the writer were carried out with *Aspergillus niger*) and the question whether aluminium is a nutritive element. The following conclusions are drawn :

1) In conformity with the results obtained by MOLISCH, MIYOSHI, and KATIC with other plants, the writer observed that the shoots of red cabbage grown in Knop's nutritive solution with the addition of 0.01 per cent of nitrate of aluminium assumed a light blue colour.

2) The disappearance of starch noticed by FLURI in *Spirogyra*, *Elodea* and *Lemna* when kept in solutions of aluminium salts, was confirmed by the writer only in the case of *Elodea*. The roots immersed in solutions of aluminium salts did not lose their starch.

3) The disappearance of the starch due to the salts of aluminium is attributed by the writer to the hindrance of the condensing ferments and to the activity of the hydrolysing ferments as well as to the weakening of assimilation (general toxic action). Evidence in support of this statement was obtained by carrying out a variation of Boehm's experiment on the formation of starch from sugar in the dark : while leaves containing no starch formed a large amount of the latter if placed for some days in a 20 per cent solution of saccharose, the starch reaction was not observed if 1 per cent of aluminium nitrate was added to the saccharose solution.

4) Salts of aluminium of 0.005 per cent concentration hindered the growth of the higher plants in the case of *Zea mays, Vicia faba, Lens esculenta, Helianthus annuus* etc. ; very dilute solutions (0.0001 per cent) on the other hand increased growth a little. Nitrate of aluminium also had a toxic effect.

5) *Aspergillus niger* cultivated in the presence of glycerine (an organic nutritive substance) received a strong impetus to growth and fructification from the addition of from 0.005 to 0.1 per cent of sulphate of aluminium. This salt on the other hand hindered growth and almost entirely prevented fructification when the fungus was given glycerine with peptone.

6) Prothalli of *Equisetum arvense* were grown on agar with mineral salts ; the addition of 0.01 per cent of nitrate of aluminium greatly favoured their growth.

PLANT BREEDING

266 – **Present State of the Knowledge of the Chemistry of the Mendelian Factors for Flower-Colour.** — WHELDALE, M., in *Journal of Genetics*, Vol. 4, No. 2, pp. 109-129 + 1 plate. Cambridge, October 1914.

This paper includes : *a*) a study of the pigments in several varieties of *Antirrhinum majus*, and especially of the yellow pigment, one of the anthocyanin pigments of *Antirrhinum* and *Centaurea*, and *b*) a discussion of the factors involved in the formation of the anthocyanin pigments.

The writer comes to the following conclusions :

1. — There are three varieties of *Antirrhinum majus*, ivory, yellow and white which do not form anthocyanin. Ivory is dominant to yellow and contains a factor " *I* " which is absent from yellow.

It has been shown by the writer that the pigments in the ivory and yellow varieties are flavones. Ivory contains a pale yellow flavone, apigenin, and yellow, in addition to apigenin, contains a deeper yellow flavone, luteolin. Hence the "*I*" factors may be represented as the power to inhibit the formation of luteoline.

The white variety contains no flavone.

2. When either the yellow or ivory is crossed with a white of suitable composition, an F_1 containing anthocyanin is produced. Therefore it appears likely that the anthocyanin is formed from a flavone by the action of some factor contained in the white. Anthocyanin might be an oxidation or a condensation product of a flavone or both.

3. Two anthocyanins have been isolated from *Antirrhinum*, red and magenta, the latter containing a "*B*" factor which is absent from the red. Analyses of the red and magenta pigments have shown that they both contain a higher percentage of oxygen than the flavones. Also, magenta has a higher percentage of oxygen than red. Determinations of the molecular weights of the red and magenta pigments indicate that the anthocyanin molecules are at least twice or three times as large as the flavones. Hence in addition to oxidation, condensation must have taken place, either between flavone molecules, or between the flavone and some other aromatic substance. In the latter case, one substance the "*R*" factor, may give red anthocyanin and a second substance the "*B*" factor, magenta. The view that anthocyanin is in part, at any rate, an oxidation product is confirmed by the researches of KEEBLE, ARMSTRONG and JONES, who have shown that anthocianin is formed in tissues most rich in oxidising enzymes, though there is no good evidence, from the well known Mendelian cases, of albinism being due to loss of an oxidising enzyme.

4. From recent researches on the pigments of the Cornflower, WILLSTÄTTER states that the flower contains three pigments ; a purple pigment which is an acid and owes its colour to the presence of a quinone nucleus and which readily passes to a colourless isomer which is a flavone derivative ; a blue pigment which is the potassium salt of the purple ; and a red pigment which is an oxonium salt of the purple with an organic acid.

5. As a result of recent work, COMBES has brought forward the hypothesis that anthocyanin is not an oxidation product but, on the contrary, a reduction product of the flavones. As evidence, he quotes experiments which bring about the formation of anthocyanin from flavones by means of sodium amalgam in acid solution and the formation of flavones from anthocyanin by treatment of the latter with hydrogen peroxide. The evidence, however, cannot be considered conclusive in the absence of analyses of the products. A similar formation of artificial anthocyanin has been obtained by TSWETT, and by KEEBLE and ARMSTRONG from plant extracts by treatment with aldehyde and strong acid or nascent hydrogen in presence of alcohol and strong acid. The artificial product has some of the properties of natural anthocyanin but differs in its solubilities. Further analyses are required for the determination of its identity.

267 – **Migration of Reserve Material to the Seed in Barley Considered as a Factor of Productivity.** — BEAVEN, E. S., (Summary from a paper read before the Agricultural Section of the British Association for the Advancement of Science at the Austr lian Meeting, August 1914) in *The Journal of the Department of Agriculture of Victoria, Australia,* Vol. XII, Part 12, pp. 733-734. Melbourne, December 1914.

With barley the ratio of the dry matter accumulated in the seed to the total dry matter of the plant when fully ripe frequently influences the produce of grain to a greater extent than any other factor ; also it is more important in barley than in either wheat or oats, because the value of the dry matter of the haulm (*i. e.* the stem and leaves) is less with barley ; also this ratio is higher in some races of barley than in any variety of the other cereals, and probably higher than in any other cultivated plant. This ratio varies considerably as between different varieties of barley and as between races of the same variety of any cereal species. It has a high value for purposes of selection, especially in the early stages of selection from amongst a limited number of individual plants obtained by artificial cross-fertilization.

As between two races, each the progeny of a single plant of the F_4 generation of the same cross, and with the same weight of dry matter in the entire plants on unit areas, the inherited and persistent difference in the ratio referred to has been found in a series of experiments to be as much as 5 per cent. In consequence of this factor alone, with the same total weight of grain and straw on unit area, the yield of grain was more than 10 per cent greater in some such races than in others.

In the case of hybrid races generally the number of individuals possessing different combinations of characters is very large, especially if minor characters affecting either productivity or quality are taken into account. The experimental error involved in selecting either individual plants, or aggregates which are the progeny of single self-fertilised plants, for the purpose of starting new races of cereals, is so great in consequence of environmental conditions, that no conclusions of practical value can be drawn, except from a very large number of observations, as to relative productivity when only the dry weight of the grain is taken into account, and then only if special methods of cultivation are adopted.

The paper describes the methods adopted in collaboration with Professor Biffen and with Mr. W. E. Gosset, and gives a summary of the conclusions arrived at, more particularly as to the value for selection purposes of accurate determination of the relative seed forming energy as shown by the " coefficient of migration " of different races of barley.

AGRICULTURAL SEEDS

268 – **The Improvement in the Standard of Quality of Agricultural Seed in Ireland.** — *The Journal of the Board of Agriculture,* Vol. XXI, No. 7, pp. 585-594 + 1 Fig. London, October 1914.

The Weeds and Agricultural Seeds (Ireland) Act, 1909, confers upon the Department of Agriculture certain powers of sampling agricultural seeds at shops and stores, and of publishing the results of tests of these seeds with the names and addresses of the vendors. Up to the present this power of publication has been exercised in one instance only. The Depart-

ment's policy has been chiefly of an educational nature and directed to bring the several interests to cooperate voluntarily in effecting the intended reform.

One of the first steps taken was the establishment of a system of agricultural instruction by means of visits to farmers by Itinerant Instructors in Agriculture. A large corps of these county instructors, supplemented by a number of agricultural overseers and their assistants is employed to advise farmers on all matters relating to practical agriculture. In addition there are winter agricultural classes organised by the County Committees of Agriculture throughout the country as well as classes in the Department's agricultural colleges and schools where young farmers are taught the importance of using good seed in preference to cheaper seeds of inferior quality. Also, in order that the farmers should have the means of ascertaining the quality of the seed supplied by the merchant, the Department set up a seed-testing station, where for a nominal fee of 3*d* a farmer can obtain a germination and purity test of his seed.

The term "agricultural seeds" is defined, for the purposes of the Act, as meaning the seeds of grasses, clovers, flax, cereals, turnips, rape, mangolds, carrots, cabbage or parsnips. The powers of sampling conferred upon the Department include not only determinations of the quality but also the source of supply of the seeds of every retail and wholesale vendor in the country. The itinerant agricultural instructors, assisted by a number of the agricultural overseers and by officers specially appointed for the purpose, visit the shops and stores of seed merchants throughout the country and take samples at the proper season each year. In 1913 the number of officers was 69 and as many as 6246 samples were taken from 1535 seed-stores; many more stocks were inspected without samples being necessary. It was found that the bulk of the seed retailed came from about 16 wholesale firms which were almost entirely Irish, most of them being "seed cleaners" *i. e.* firms who buy the seed crop from the grower and prepare it for the market by special machinery. Examination of the samples taken under the Act disclosed the fact that a proportion of the trade in grass seeds of most of these firms consisted in the sale of very inferior mixtures containing "cleanings" or "blowings". With a view to stopping this supply at its source the Department of Agriculture approached the firms concerned and arrived at the following agreement: no Perennial Ryegrass seed shall be sold in Ireland with a bushel weight less than 20 lbs. and no Italian Ryegrass with a bushel weight less than 16 lbs., nor any seed containing such materials as white and brown hay seed "cleanings", "blowings" and *Holcus*. A very considerable improvement in the quality of the seed retailed in Ireland has already been observed.

The Department has also sought to effect improvement through the retailer and has provided special local classes for traders in which instruction is given regarding the characteristics of good seeds, the methods of identifying the more important classes of seeds and their principal impurities, seed testing and the facilities afforded by the Department in this connection as well as the provisions of the Weeds and Agricultural Seeds

(Ireland) Act. Information is also given by the itinerant instructors in agriculture during visits to seed shops.

Another branch of the Department is concerned with improvements in quality by plant breeding on scientific lines. Attention is first given to determining the best varieties of each species suitable to the local conditions. The work was begun with cereals and since 1901 extensive variety experiments have been conducted with barley, wheat and oats. As a result of these tests the number of desirable varieties has been reduced to one or two for each cereal. By means of demonstration plots, the superiority of pedigree seed was shown and a demand for it was created. This demand was met by propagating the best varieties from single ears, and, when sufficient seed was obtained to sow large plots in the country, the produce was placed in the hands of persons interested in the distribution of good seed in their respective districts. It was thus further propagated until there are now many thousands of acres sown with the strains of the three cereals originally raised by the Department. This work is being supplemented by hybridisation experiments and it is hoped to produce still better varieties in the near future. Attention is also being directed to the improvement of flax and clover seed.

The improvement in the condition of rye-grass seed is encouraged by offering prizes for competition at the principal seed markets.

In 1900 a seed-testing station was founded. During the 14 years of its existence more than 19 000 samples of seed have been tested, the average for the last 4 years being over 2 000 per annum. A purely nominal fee is charged to farmers, whilst seed vendors are charged 2*s* per sample. The present work of the station may be divided into three main divisions: *a*) testing samples of seed for farmers and Irish seed merchants; *b*) examining and testing samples of seeds taken under Part II of the Weeds and Agricultural Seeds (Ireland) Act, 1909; *c*) general advisory work involving seed-testing. The results of the tests of Act samples are intended for the information and use of the Department alone, though in certain cases they have been communicated to the merchants and retailers with gratifying results.

The station is at present located in the Royal College of Science, Dublin.

The purity test is determined by weight; the percentage germination is determined with 500 cleaned seeds and sometimes with 900 seeds. The methods of analysis adopted at this station are generally analogous to those employed in the various European stations, though with the following differences: *a*) all impurities including weed seeds, dirt and empty seeds are removed before testing in Continental laboratories whereas by the Irish method tests are carried out on the seed as it is retailed to the farmer; *b*) at the Irish Station each sample is tested with a control, the germination of which is already known. If the control does not give its reputed standard of germination the test is discarded and a second one instituted.

269 – **Impurities in Seeds in Victoria, Australia** (1). — *Communicated by* S. S. CAMERON *Director of Agriculture.*

Report on seed examined in October and November 1914.

Kind of seed	Country of origin	Weed seeds: Species	Weed seeds: Percentage	Percentage of non-germinable seed	Percentage of diseased seeds	Quantity examined
Alfalfa (*Medicago sativa* (*)	Australia	*Amaranthus retroflexus*	0.02	2.33	nil	3 oz.
		Rumex crispus	0.007			
		Lepidium draba	0.87			

(*) This sample contained also 0.004 per cent of ergot (*Claviceps purpurea*), as well as a large quantity of stripped rye-grass seed and stalks (2.63 per cent) and a quantity of grit. It was badly infested with mites and had to be fumigated.

270 – **Acclimatisation Experiments in Italy with Varieties of Japanese Rice.** — POLI, POLO, in *Il Giornale di Risicultura*, Year IV, No. 22, pp, 333-335. Vercelli, November 30, 1914.

CEREAL AND PULSE CROPS

The experiments described in this article were carried out in the experimental field of the Rice Growing Experimental Station of Vercelli. The ground used was a three-years-old rice field which had been fertilized by green manuring with clover, and by the application of 530 lbs. of superphosphate and 132 lbs. of calcium cyanamide per acre before sowing, and 132 lbs. of nitrate of soda per acre as a top dressing on June 20. The Italian varieties Ranghino, Nero di Vialone, Lencino and Sancino served as controls. The rice yield in lbs. per acre was as follows :

	lbs. per acre		lbs. per acre
Early Japanese Varieties:	—	*Late Japanese Varieties:*	—
Sekaichi	2 611	Onsen	6 197
Jojirushi	2 620	Oba	4 854
Takatzù	4 348	Wase-Shinriki	6 047
Okidate	4 742	*Italian Varieties:*	
Kitakawa	3 671	Ranghino	3 498
Shiraigha	3 136	Nero di Vialone	3 860
Bungo	3 451	Lencino	5 246
Sekiyama	4 292	Sancino	5 810

The early varieties gave the lowest yields and the late ones the largest crops. The former are all bearded, the latter, are all unbearded. In spite

(1) See also *B.* Feb. 1915, No. 163. (*Ed.*).

of heavy manuring, the early and late varieties alike showed themselves very resistant to brusone (rotten neck) and similar forms of disease, the early varieties, however, have the defect of lodging readily to which the writer attributes their low productiveness.

Amongst the late varieties, Onsen ripened its grains, Wase-Shinriki did not reach complete maturity Oba is perhaps still a little later but of excellent quality. All three greatly resemble the respective original varieties.

All the Japanese varieties produced white transparent seed which bears comparison with good samples of the same grown in Japan.

271 – **The Effect of Transplanting upon Rice Production.** — POLI, POLO in *Il Giornale di Risicoltura*, Year IV, No. 24, pp. 362-365. Vercelli, December 30, 1914.

In the experimental field of the Rice-growing Station at Vercelli, systematic experiments have been carried out to ascertain the effect of transplanting upon rice production. The latter operation was effected in the same soil in which the sowing had taken place and from which were taken the seedlings for transplanting. Thus, in the case of one of the experimental varieties, Ranghino, the transplanting was effected in ground immediately adjoining the plot in which it had been sown and from which the seedlings for transplanting had been thinned out. The seedlings were moved early in June and planted, (as is the rule) in tufts of 3 to 4 at a distance of 10 to 12 in. apart, the tufts being arranged in a quincunx.

After the usual period of taking root, the leaves grew luxuriantly and the plants were green until after the beginning of July, developing and tillering in a satisfactory manner. The same varieties of rice which lodged when grown where they had been sown, showed, in the transplanted plots, a noteworthy resistance, and it was only when nearly ripe that some of them, for instance Shiraighe and Jojiruschi, lodged, and then with little injury to their yield. The proportion of aborted grains was much less and the straw was stronger and hardier.

The numerical results given by this first experiment were as follows :

Variety	Yield in lbs. per acre	
	Untransplanted	Transplanted
Onsen	6 197	5 911
Shiraighe	3 137	4 983
Sckiyama	4 293	5 745
Takatzu	4 348	5 243
Jojirushi	2 620	6 610
Nero di Vialone	3 860	4 197
Lencino	5 247	4 100
Runghino	3 498	5 412

Only the Onsen and Lencino varieties gave inferior results; and it is noteworthy, that while the other untransplanted varieties suffered injury from lodging, these two, which seem not to bear moving, proved very resistant to lodging. The writer, who is continuing the experiments, con-

siders that he has now proved that by transplanting, it is possible to maintain good crops, especially, in the case of those varieties of rice which have the weakest straw.

STARCH CROPS.

272 – **Experiments to Compare Results of Planting Whole *versus* Cut Sets of Potatoes at the Upper Shillong Agricultural Station, Assam, British India.** — BASU, B. C., in the *Annual Report on Agricultural Experiments in Assam*, pp. 31-54. Shillong 1914.

Among other experiments was tried that of the relative results of sowing whole and divided tubercles of potatoes, the varieties used being King of Potatoes and Magnum Bonum . The results of previous years were confirmed. There was very little difference in the outputs. Thus King of Potatoes whole tubers gave 216 maunds of 82 lbs. and Magnum Bonum 214 maunds per acre, while tubers divided into 2 halves gave in both cases about 205 maunds. Thus both methods are equally good. Only it would be as well to avoid dividing in the case of very small tubers, and, on the other hand, to cut when there is fear of infectious disease, as this would give the chance of detecting and discarding unsound sections.

FORAGE CROPS. MEADOWS AND PASTURES.

273 – **A Critical Contribution to the Solution of Some Present Questions Relating to Meadow Cultivation.** — BERKNER, F., in *Mitteilungen der Landwirtschaftlichen Institute der Königlichen Universität Breslau*, Vol. VII, Part II, pp. 235-365. Berlin, 1914.

In 1903 there was instituted in connection with the Chair of Agriculture of Königsberg a Consulting Bureau to deal with all questions relating to pastures and meadows. Similar bureaus were subsequently started at Wittstock. a D., Treubritzen, Prenzlau, Friedeberg Nm. Schwiebus and elsewhere. A central office was established, connected with the Agricultural Chamber of Berlin, for the improvement of meadows and pastures and this is in touch with the above-mentioned consulting Bureau.

Having been appointed Chief of the above Königsberg bureau from the date of its establishment, the writer had the opportunity of making numerous observations regarding pasture and meadow cultivation which he confirmed by experimental work, thereby convincing himself that the prolonged productivity of a meadow, under given conditions, depends upon a relatively small number of groups of predominant plants. Mr. BERKNER therefore planned a new series of experiments, these he carried out on plots of 120 sq. yards each, beginning in 1906. The district he selected was one of the most rainless parts of Germany (near Königsberg); in the 7 years 1906-12 the average annual rainfall was 453 mm. (17.84 inches). However, 52.5 per cent of the rain fell during the period of active vegetation, viz., between April and August. The experimental ground was a poor meadow which had never been fertilised within the memory of man. It consisted of a stratum of peat 6 in. thick resting on a humiferous black sand ; it was excessively damp. The preliminary work consisted in making drainage ditches, in a superficial autumn ploughing supplemented by repeated working in the spring, and in liming.

The results of these experiments are summarised as follows :

1) The results of one year's manuring trials on meadows should be received with caution, even when the experiments are furnished with several series of controls, because *a*) it is generally the quality rather than the quantity which the fertiliser affects the first year; *b*) the bad effects of previous irregular fertilising can make themselves felt ; *c*) every species of plant is helped, or hindered in its development by one or more nutritive substances and this in a perfectly determined manner, hence it is impossible to judge of such action until some years have elapsed ; *d*) in normal meadows, there is a certain equalization in the vegetation between the first and the second cutting, as there is in different years, thus, only the average production of several years can show in a reliable manner the effect of the fertiliser upon the crop.

2) The regular use of a potassic-phosphatic fertiliser has generally proved useful in increasing the yield ; when the price of hay is low the highest net profit is obtained with this substance.

3) On an average, 1 cwt. of nitrate of soda, gave an increase of 5.3 cwt in the hay crop, and proved unremunerative when the price of hay was low. Nitrate of soda did not prove to be superior to ammonium sulphate.

4) Of phosphatic manures, superphosphate gave on the whole the best results though hardly superior to basic slag; the effect of " Agrikultur-phosphat " was less favourable.

5) Liming did rather more harm than good.

6) Manuring with nitrate of soda never left any unexhausted fertility in the soil, but this was evident where ammonium sulphate had been used. residues were greatest *absolutely* on the plots which every year were twice treated with phosphates and potash in the form of kainit and basic slag, and *relatively* greatest in those that were manured with " Agrikultur-phosphat ". As far as the intensity of the unexhausted fertility was concerned, it was impossible to determine any great difference between the phosphoric acid which was soluble in a citric acid solution and that soluble in water.

7) The various fertilisers have different effects upon the plants. nitrogenous fertilisers favour the development of Gramineae and potassic-phosphatic mixtures the growth of Leguminosae. Every kind of fertiliser however, decreased either the number of the good species of meadow plants or the number of weeds. Potash alone did not encourage the development of Leguminosae, but only when mixed with phosphates. The several forms of phosphates had an essentially different effect upon the growth of Leguminosae, the least efficacient being raw phosphate, and the most efficient, superphosphate. In addition superphosphate increased the number of species of Leguminosae and rendered their development less dependent upon climatic conditions; it is not clear whether this increase is more due to the action of the soluble phosphoric acid, or to the sulphate of lime in the superphosphate.

8. The soil reaction appears to have more influence upon the growth of Leguminosae than has hitherto been supposed ; the various meadow species appear to behave very differently in this respect. The composition

of the flora was best on plots fertilised with kainit and superphosphate and the nutritive value of the hay was also higher. Nitrogenous fertilisers seemed especially good for high-growing meadow Gramineae, and particularly for meadow fescue and tall oat grass.

9) The amount of water present in the forage depends upon the season and the fertiliser, it is larger in the first crop than in the second, and a little higher in wet than in dry years (at any rate in the case of the first cut); it was also higher in the plots which received exlcusively potassic-phosphatic fertilisers than in those that were not manured. In general, the water content of hay depends on its botanical composition, being greater if Leguminosae predominate and less where Gramineae are most plentiful. A phosphatic fertiliser applied alone with a nitrogenous one seems to raise the water content of the crop a little more than a potassic fertiliser does. Sulphate of ammonia gives a more watery forage that nitrate of soda, as it promotes leaf development. The utilisation of rainfall by meadow plants greatly depends on the average annual temperature and is greatest where high temperatures occur most frequently.

10) The difference between the crops of dry and wet years is more conspicuous in those plots where a potassic-phosphatic fertiliser had been used than where complete fertilisers had been employd. The yield of the plots manured with nitrate is larger in dry seasons than that of the plots manured with ammoniacal nitrogen; in damp seasons the reverse occurs. The difference between the crops of dry and wet years on the plots treated exclusively with mineral fertilisers is less when superphosphate is used than when they are treated with basic slag and kainit.

11) The decrease in production in dry years, partly due to the deficient development of the Leguminosae, is connected with differences in transpiration intensity on the partl of Leguminosae and Gramineae; it is possible that it is also affected by the diminished respiration of the roots of Leguminosae. The continued satisfactory growth of Leguminosae and Gramineae in a meadow and the continued productivity of the latter is connected with a certain natural rhythm in the development of the two groups of plants. This rhythm represents a kind of rotation and prevents the soil sickness caused by Leguminosae.

12) The colour of the meadows shows which of the indispensable nutritive elements are present in the soil. A greyish hue in the resting period of vegetation denotes a deficiency in potash and phosphates, while a greener tone proves that the soil has always been well fertilised with potash and phosphates. When the stubble is dark green, phosphates are wanting; a yellow or brown coloration of the tips of the leaves points to an insufficiency of potash.

13) The yield of natural meadows is usually in direct relation to the natural productivity of the soil, and of somewhat poor quality; the number of wild species of plants decreases more rapidly in the fertilised than in the unfertilised plots. When Gramineae and Leguminosae suitable to the soil are carefully selected, the amount of seed used for each species is of less importance than is generally believed, as suitable species will

spread irrespective of further seed supplies. The practice of covering the meadows with a mulch (potato tops, cereal and Leguminosae straw etc.) does not produce the expected increased yield in most cases, for it forces the vegetation which is therefore more susceptible to injury caused by frosts.

274 – **Lucerne from Different Countries Grown at Svalöf from 1911 to 1914.** — WITTE, HERNFRIED, in *Sveriges Utsädesförenings Tidskrift*, Year XXIV, Part 5, pp. 293-301. (German Abstract, pp. 301-303). Malmö, 1914.

The writer begins by giving a rapid summary of the history of lucerne growing in Sweden. It appears that this plant was cultivated for the first time, successfully on a large scale, from 1770-1780 in the neighbourhood of Stockholm. During the following century, crops of alfalfa were raised here and there in Sweden but it was not grown to any considerable extent until towards the end of the nineteenth century.

The writer had previously carried out trials with lucerne from Hungary, France, Italy and Turkestan (*Fühlings Landw. Zeitung*, 1911, pp. 47-53) which showed that the Hungarian varieties gave the best results. In order to ascertain the cultural value of lucerne from other countries also, another experiment was begun in 1911 and continued until 1914. Nineteen varieties were tried, being imported from Hungary, Russia (Podolia), Bulgaria, Germany (including one from Iphofen in Central Franconia), France, Italy, Spain, Turkestan and North America. Two samples of "Sand Lucerne" (*Medicago falcata* × *sativa*) were also tested and proved to be true lucerne.

The seeds from each locality were sown in experimental plots 2 × 5 metres (6.6 × 16.4 ft.) and in rows 25 cm. (10 in.) apart, in May 1911. The crop was not cut the year it was sown, but in the following three years it was cut three times each season. The total yield of green weight per acre in the three years varied from 65.5 tons obtained from the Russian lucerne to 37.4 tons produced by the North American. Taking the production of Hungarian lucerne as 100 (62 tons in the three years and nine crops), the production of the other lucernes was as follows : Russian 105.6, " Sandlucerne " 92, German (Franconian) 90.1, Bulgarian 89.5, Turkestan 84.3, Italian 83.4, French 77.3, German 77, Spanish 67.9, North American 60.2. The Hungarian lucerne gave excellent crops, especially, in the second and third years; the Russian surpassed it the first season, but was a little inferior in the other two seasons. The Bulgarian lucerne was equal to the Hungarian the first year, but was afterwards somewhat inferior to it. The Franconian yielded about 10 per cent less than the Hungarian. The French and Italian lucernes were inferior to the Hungarian, especially in the third year, and their durability was in general less. The Spanish was less productive and durable, as well as less resistant to cold than the French, nevertheless after the first six cuttings it shot out again more vigourously than all other varieties. The Turkestan lucerne was inferior to the Hungarian and was especially weak in shooting, particularly the third year. The North American was of little value, producing few shoots after cutting ; further, it was much attacked by *Peronospora trifolium*. Taking the total amount of lucerne cut in three

years as 100 in each case, the relative productions in the period may be expressed as follows:

	1st year	2nd year	3rd year
Hungarian	49.2	30.8	20.0
Spanish	41.3	31.4	27.3
Turkestan	53.0	32.0	15.0
North American	52.0	35.8	12.0

If the European lucernes be divided into two groups, a south-east group consisting of Hungarian, Russian and Bulgarian lucernes and a south-west consisting of French, Spanish and Italian varieties, and the average production of the first group during the three years (61.3 tons per acre) be taken as 100, then the average production of the second group was 76.5 while that of the Turkestan and North American lucernes was 83.3 and 61 respectively.

The experiment shows the most suitable lucerne for cultivation in Sweden is that from south-eastern Europe, and especially Hungarian lucerne on account of its durability, resistance to cold and its rapid growth after cutting.

275 – **The Production of Fine Sea Island Cotton in the West Indies, with Particular Reference to the St. Vincent Industry.** — *Imperial Department of Agriculture for the West Indies — Cotton cultivation in the West Indies.* — Pamphlet Series No. 74, pp. 118 + 35 fig. Barbados, 1914. — Abstracted in *Journal of the Royal Society of Arts*, Vol. LXIII, N. 3242, pp. 148-149. London, January 8, 1915. FIBRE CROPS

At least 130 years ago a fine cotton, presumably Sea Island, was grown in the West Indies. Seed was sent to the United States, where, it is stated, a stock was gradually matured with an annual habit directly adapted to the climatic conditions of a limited tract of country. This special stock, according to Sir George Watt, embraces all the finest grades and most valuable cottons of the world, and is in fact true Sea Island, now known botanically as *Gossypium barbadense* var. *maritima*, Watt.

The cultivation of long-stapled cotton was never completely abandoned in the British West Indies, but was confined after the American Civil War to a small production in the Grenadines. The revival of fine Sea Island cotton-growing, however, dates from the year 1901, when small experimental plantings were made in this and the following year from seed obtained from the United States. The results were very promising. In 1903 a large supply of seed was obtained of the fine River's type, produced on the seaboard of South Carolina. This variety is still largely grown as are also other fine varieties obtained through the British Cotton Growing Association and others. In the year 1905 the American growers of the finest Sea Island cotton combined to prohibit the exportation of seed; but this action had little or no effect on the West Indian industry, for it was proved by this time that with careful local selection and cultivation the quality of the cotton could be maintained and in many instances improved, with the result that to-day the finest cotton in the world is produced in certain of the islands.

The chief British islands exporting Sea Island cotton are St. Vincent, St. Kitts, Barbados, and Montserrat, but the industry, is successfully carried on in several of the others. St. Vincent, besides being the premier cotton-growing island, also produces the most valuable cotton. In St. Kitts, however, where the soil and climatic conditions are somewhat similar to those of St. Vincent, some exceptionally fine cotton is grown. In the paper now submitted it is proposed to refer more particularly to the St. Vincent industry, because:

(*a*) The British Cotton Growing Association advises West Indian planters to cultivate for fineness of lint, in view of the competition of certain Egyptian and American cottons with some of the cotton produced in the West Indies, but not with that of St. Vincent;

(*b*) The methods adopted in the production of cotton in St. Vincent and the measures taken for the protection of the industry have been under closer governmental control than in any other island; and

(*c*) The highest degree of success has been obtained in the production of fine cotton.

The soil of St. Vincent is of volcanic origin throughout, and may be classed as a dark sandy loam. With the exception of St. Kitts, the soils of other islands, are, as a rule, heavier in character. The rainfall of St. Vincent is ample and often excessive, and exceeds that of the other Colonies.

Mention has been made of the introduction of the River's and other fine types from South Carolina, and it is from these that the successful local industry has been built up. Great care had to be excercised at the outset to ensure that only seed from the best fields of plants true to type was planted. The seed now used for planting is all obtained from nurseries or selected crop lots, and is tested, selected, and sterilised before being sown. The seed selected must be heavy and sound with a tuft of green fuzz at one or both ends. Arrangements are made with planters by the Agricultural Department to grow special fields from seed from selected plants at the experiment station in order to keep up the standard of cotton grown by small growers. Most of the large estates now maintain their own nurseries. The methods adopted in plant selection are based on desirable, field characters of the plant, yield of seed-cotton, length, fineness, strength, uniformity, and lustre of the lint. Plant selection for resistance to certain bacterial and fungus diseases is also largely carried out and with promising results.

The work of maintaining the quality and yield of cotton in St. Vincent has been greatly facilitated by the enacting of certain legislative measures. Under the ordinance for the prevention of the introduction of pests and diseases, power is given the Agricultural Authority to destroy, fumigate or sterilise all seed-cotton or cotton seed brought into the Colony, and the provisions of the ordinance are strictly enforced. The seed supply is under close control.

A third ordinance which has an important bearing on the industry is that providing for the destruction of all cotton plants at the end of each season in order to prevent the carrying over from one season to another

of certain pests and diseases. As the provisions of this measure cover all kinds of cotton, whether wild or cultivated, it has been possible to destroy all the perennial wild or semi-wild types and so reduce to a minimum the danger of cross fertilisation of the valuable Sea Island variety with undesirable kinds.

The prices obtained for St. Vincent Sea Island white cotton during the past three seasons have ranged from 2*s* to 2*s* 9*d* per lb. for the " superfine " and from 1*s* 6*d* to 1*s* 11*d* for the " ordinary ".

276 – **The Rejuvenation of Abaca Fields in the Philippines.** — NICKLES, F. P., (Agricultural Inspector) in *The Philippine Agricultural Review*, Vol. VII, No. 10-12, pp. 411-419, + 2 Plates. Manila, P. I., December 1914.

At present there does not seem to be any crop which may be grown extensively in rotation with abaca and the usual practice of applying commercial fertilizers or animal excrement is in the majority of cases too expensive to be justifiable. Cultivation necessitates the expenditure of money, and, since the returns per acre are relatively low in this industry. the problem is to keep this expenditure down to a point where it is justified by the increase in profits. This has been accomplished by the use of cowpeas (sitao) as a cover crop and green manure.

The preliminary cleaning of the land should begin in the last part of the dry season when conditions facilitate the destruction of weeds. All trees should be dug up and burnt as it is better to plant shade trees later where necessary. The land should then be ploughed not less than three times to a depth of 20 cms. and finally harrowed once or twice. Planting should be done at the beginning of the rainy season and the cow-peas should be sown broad-cast first. They should be sown thickly and evenly and harrowed in. Where it is necessary to plant the abaca first, the cow-peas should not be sown until the abaca is up and they should be covered by means of a cultivator running between the rows. The abaca should be planted before the cow-peas are up, in holes 20 to 30 cms. in diameter and 30 cms, deep in check rows 3 metres apart.

The root-stocks or underground part of the stalk should be used; those about 12 to 15 cms. in diameter being better than larger or smaller ones. Each piece should have at least three healthy buds. The usual custom is to transplant large plants as a whole, but the roots are liable to be damaged and the subsequent growth impoverished.

In some provinces shade trees are considered to be of great value, but not absolutely necessary. If used, they may be planted any time after planting the abaca, the best for the purpose being leguminous trees such as " dap-dap " (*Erythrina indica* Lam).

After planting the abaca no attention is required until the cow-peas have matured, a period of 3 to 3 ½ months. The seed is harvested by hand-picking and used for subsequent sowings, while the vines are ploughed in as green manure . The cow-peas are re-sown and ploughed in again every 3 or 4 months for a period of 14 to 18 months. At the end of this period the abaca is sufficiently well grown to completely shade the ground and prevent the growth of weeds. Peanuts and some other leguminous crops

could be used, but generally their growth is not heavy enough to give full protection from weeds.

No further cultivation is required for the abaca until after the 4th or 5th year or until the field has been harvested three or four times when the sun again penetrates to the soil and measures are necessary to check the growth of weeds.

The present yield of fibre varies from 342 lbs. to 517 lbs. per acre (380 kilos to 575 kilos per ha.) and under the above system yields of from 585 to 900 lbs. per acre (650 to 1000 kilos per ha.) are obtainable.

Taking the daily wage of labourers at 1*s* 3*d* the cost of this system works out as follows :

	Cost per acre £	*s*	*d*
Clearing	1	7	10
Ploughing and harrowing		9	3
Preparing root stocks, planting cowpeas and abaca	1	3	2
Total preliminary expenses	3	0	3
Ploughing under and replanting cowpeas 4 to 6 times.		18	7
Total expense during first 18 months	3	18	10

With slight modifications the above method may be advantageously adopted in the planting of new land.

CROPS YIELDING OILS, DYES AND TANNINS

277 – **The Tanning Barks of Victoria, Australia.** — *The Journal of the Department of Agriculture of Victoria*, Vol. XII, No. 10, pp. 609-610. Melbourne, October, 1914.

The supply of tanning barks is obtained from naturally occurring species of acacia trees in the Victorian forests. The best bark is grown towards the west of Victoria and it becomes less valuable towards the east, *i. e.* towards Gippsland. The Golden Wattle varies least in value from one locality to another. Very good bark comes from the district within 30 or 40 miles radius of Portland and good bark is also obtained from districts round the Grampians.

Trees can be stripped at 6 to 7 years of age, an operation followed by the death of the tree.

The production of bark in Victoria does not keep pace with the demand owing to the extension of cultivation and grazing. Acacias can be artificially grown on the poorer soils with remunerative returns. The plants have several natural enemies, particularly "woolly blight" (*Schizoneura lanigera*), "borers" and fire blight which quickly damage a plantation and must be suppressed. The Forestry Department of Victoria has 20 000 acres of natural wattle plantations which are of considerable value. The cost of handstripping is £2 to £2 5*s* per ton. The sale price is now £0 5*s* to £8 per ton according to quality. The annual out-put of bark is 11 363 tons — all used locally. In addition there is a small quantity of bark imported from South Africa.

278 – **A Contribution to the Study of *Funtumia elastica*.** — HENRY YVES, in *Le Caoutchouc et la Guttapercha*, Year 11, No. 129, pp. 8549-8559. Paris November, 15, 1914.

The notes published by the writer are the results of observations made during his journeys to the West Coast of Africa, notably to the Gold Coast, Dahomey, Nigeria and Gabon. His forest observations were made chiefly in the Gold Coast in the course of a mission undertaken in the company of P. AMMANN and A. GIRAUD.

A. *Summary of Observations.* — The writer publishes the results of individual observation of 129 trees of *Funtumia* on the Gold Coast, taking into account the circumference at 3 ft. 4 in. from the ground, the height at which the tree was tapped, the total yield and the yield per running foot of height of the tree, the habitat and the previous tappings.

The tapping was carried out, with the native implements and according to the native method, early in the morning. It was begun at the end of the dry season in the Adinan district and prosecuted in the rainy season in that of Amnao. Most of the trees treated grew in open forests, or forests planted on old cultivated land. In this type of forest *Funtumia* grows well and easily becomes predominant.

In Table I the writer has summarised his comparative observations on the maximum, average and minimum yield of latex.

TABLE I. — *Compared yields of latex.*

Average circumference of trees, inches	Average height tapped of trees, ft. in.	Total length of incisions ft. in.	Average yield in cc. per tree	Average yield in cc. per foot of incision	Individual yield in cc. per foot of incision: per tree on damp soil	Individual yield in cc. per foot of incision: maximum recorded	Individual yield in cc. per foot of incision: minimum recorded
			Dry Season.				
15.7	19 8	36 1	132	3.6	—	—	—
22.7	22 11	45 11	147	3.0	—	—	—
24.0	29 6	60 4	208	3.4	—	—	—
			Rainy Season.				
11.8	15 1	9 10	150	5.6	10.5	6.6	1.6
13.8	20 8	36 1	173	4.7	8.6	7.7	0.9
15.8	17 9	32 10	148	4.4	—	6.8	1.3
17.7	21 4	42 8	191	4.4	—	7.3	2.0
19.7	23 7	47 7	232	5.0	10.0	7.0	1.7
21.7	26 7	52 6	240	4.5	—	7.5	2.4
23.6	28 10	59 9	290	4.8	10.1	7.0	2.4
25.6	39 4	88 7	408	4.5	—	7.5	2.4
27.6	31 10	72 2	343	4.7	9.3	7.2	2.1
31.5	40 4	98 5	431	4.3	—	8.0	2.6
33.5	36 1	91 10	347	3.7	—	—	—
35.4	42 8	118 1	588	4.9	—	—	—
41.3	39 4	111 6	588	4.9	—	—	—

B. *The effect of the season upon the yield.*

It is currently said among the natives that the latex yield at the end of the rainy season is almost double that obtained in the dry season. The figures obtained by the writers confirm this opinion (Table II.).

TABLE II. — *The effect of the season upon the yield.*

Girth of trees	Average latex yield per tree in cc.		
	Dry season	Rainy season	Difference
Inches	cc.	cc.	per cent
15.7	132	145	13
22.7	147	240	63
24.0	208	290	40

Thus there may be a difference of over 50 per cent.

C. *The effect of habitat.* — The habitats which are most favourable to obtaining a high yield are the base of hills and the bottom of " talwegs " where the soil is permeable and always damp, but where the water never stagnates. The high dense forest does not seem calculated to produce much latex in *Funtumia,* most of the minimum returns were obtained from trees growing in such surroundings.

D. *Effect of age.* — Except in individual cases, there is, on an average, no marked difference in the thickness of the laticiferous tissue of trees of different ages and sizes.

E. *Effect of tapping.* — The data collected show the constancy of the latex per foot of incision in the case of virgin trees (5.4 to 6.3 cc.) and the gradual decrease in yield as soon as the trees have already been tapped. This decline is very variable according to the series of size and these variations may be as much due to individual peculiarity as to the number of times the tree has been tapped; the average is from 1.5 - 1.8 cc. per foot of incision or about 25 to 30 per cent. Although there are not sufficient data to know whether the yield of a tree that is moderately tapped is maintained, or whether it decreases in proportion to its exploitation, individual returns show that there are no perceptible and constant differences in the yield per foot of incision, between trees which have been tapped once or twice and those which have been tapped three or four times.

These observations are in contradiction to the opinion that a *Funtumia* that has been tapped three or four times according to the native method is destined to perish from weakness and necrosis due to insect attacks.

Such cases do occur but much less frequently than is commonly supposed and in no way decrease the possibility of a good yield from a tree which has been properly treated, even according to the native method.

F. *Effect of individuality.* — In conditions of development that are as similar as possible and in the case of individual trees of the same girth,

nd consequently of about the same age, it has been observed that the atex yield varies from one to fivefold and usually from one to threefold.

G. *The rubber yield of Funtumia elastica.* — The rubber yield has been alculated on the above-given latex yield at the rate of 380 gms. per gallon f latex. This figure represents the average found in a certain number of atex samples at the beginning and at the end of the rainy season.

The maximum yields per series, which are from 115 gms. in the case f trees of a circumference of 11.8 in. to 348 gms. in that of those of 19.7 in. re obtained from exceptional individuals differing from others in being irgin trees, or inhabitants of the bottom of " talwegs, " or in the length of he incisions. The minimum yields are often seen in trees with yellow latex, r those covered with moss or large swellings. But all else being equal, here are found in the same series individual variations in yield ranging rom one to fivefold.

As is shown by Table III, the average yield increases with the girth f the trees; this seems to depend exclusively upon the fact that the thicker he tree, the higher it is, and the further tapping can be carried out in both irections. From the practical point of view, it is only the average yields hich should be considered and which give an exact idea of the latex to e obtained from the wild *Funtumia* in the surroundings in which it has een observed. For this reason, Table III has been reproduced.

TABLE III. — *Connection between the girth and the yield of the trees.*

Girth of tree	Average rubber yield	Girth of tree	Average rubber yield
inches	gms.	inches	gms.
11.8	60	25.6	165
13.8	70	27.6	138
15.8	54	31.5	173
17.7	77	33.5	139
19.7	94	35.4	235
21.7	97	41.3	223
23.6	117	—	—

By tapping well-developed trees a second and third time, larger yields n be obtained.

In a series of tests carried out contemporaneously on plantation and rest trees of a girth of 20 inches or more, the average yields per tree were gms. in the case of the plantation *Funtumia* and 51 gms. in that of the ild ones.

From all these data, the following conclusions may be drawn with rtainty :

1) The yield of latex per running foot of incision of *Funtumia* is nall as compared with *Hevea*, and consequently it is necessary to adopt

tapping methods permitting the greatest length of incisions withou endangering the life of the tree.

2) Plantations of *Funtumia* should not be tapped till their 9th o 10th year, the age when they attain a girth of from 22 to 24 inches.

3) The investigations seem also to show that this tree is inclined t give less latex when grown in plantations than when it is wild. In all cases and for the same reasons that make open forests the most suitable habitat the writer considers that very dense plantations should be systematicall thinned as the trees develop.

279 – **The Planning of Experiments with Rubber Trees.** — BARROWCLIFF, M., in *Th Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 1, pp. 1-6. Kuala Lumpu F. M. S., October 1914.

Experiments with rubber trees are liable to incur many unsuspecte sources of error with the result that various experimenters have obtaine very contradictory conclusions. Even after taking the greatest care i the selection of the trees for the different plots it is of the utmost importanc that the daily records of each plot should be recorded at least six month before the commencement of the experiment. In addition to comparin the yields of the different plots amongst themselves it is necessary to kno something of the performance of each individual plot both before and du ing the experiment. This is best realised by plotting the yields of the plot in the form of graphs during the whole period of the observations. In th way a more comprehensive and accurate view is obtained of the exter and duration of the action of the manure or other factor under in vestigation.

SUGAR CROPS

280 – **Manuring Experiments with Sugar-Cane in 1913.** — HARRISON, J. B.,, BANCROF C. K., and WARD, R., in *The Journal of the Board of Agriculture of British Guian* Vol. VIII, Nos. 1 + 2, pp. 45-57. Georgetown, Demarara, October 1914.

Nitrogenous manures. — The mean returns on 39 varieties of sugar cane with normal and high manurings — 300 and 450 lbs. of sulphate o ammonia per acre respectively — were as follows :

Plot	Tons of cane per acre.		
	No nitrogen	Normal, 300 lbs. sulphate of ammonia	High, 450 lbs. sulphate of ammonia
I	8.8	14.3	19.0
II	13.4	23.8	26.7

The meteorological conditions during the year were favourable to th sugar cane. In 1912 when the rainfall was considerably below the averag the additional 150 lbs. of sulphate of ammonia increased the yield from 5 tons to only 7.2 tons per acre.

The comparison of the action of nitrate of soda and of sulphate

ammonia applied in equivalent proportions — 60 lbs. of nitrogen per acre — gave the following mean results :

Plots	Tons of cane per acre		
	No nitrogen	Nitrate of soda	Sulphate of ammonia
I.	8.8	15.5	15.7
II	12.6	18.2	24.1
III	12.8	17.1	22.8
Means . . .	11.4	16.9	20.9

These results show the superiority of sulphate of ammonia during this particular season when the rainfall was normal, but during 1912 the opposite was the case since under low rainfall nitrate of soda is the more effective manure.

The comparison of plots continuously manured for several years with nitrate and ammonia showed the general superiority of sulphate of ammonia for the conditions in Guiana.

Experiments conducted during 4 years with 16 varieties to compare the effectiveness of the various forms of nitrogenous manures gave the following figures for the mean annual increases by the use of 60 lbs. of nitrogen in the various forms :

Sulphate of ammonia.	9.4	tons per acre
Nitrate of lime.	6.7	» » »
Nitrolim	5.9	» » »
Nitrate of soda	4.0	» » »

On this particular soil (a heavy clay) sulphate of ammonia is by far the most effective. Experiments with dried blood were unsatisfactory.

Nitrogenous manures in combination with potash and phosphates. — Data have accumulated of recent years pointing to a possibly injurious action on heavy clay soil of the soluble salts in manures applied continuously. The following results show the effectiveness of sulphate of ammonia alone and in combination with potash and superphosphates.

	Tons of cane per acre		
	Sulphate of ammonia		
	200 lbs.	400 lbs.	500 lbs.
Alone	5.6	11.1	12.3
With potash and superphosphates	4.7	8.3	10.1

Similar results were obtained in former years of normal rainfall, but in years of abnormal drought and short period of growth, as in 1911-12, higher yields were obtained on the plots receiving potash and superphosphate.

Phosphate alone. — Comparison of basic slag with superphosphate with six varieties gave results as follows :

	No phosphates	Tons of cane per acre Superphosphates	Basic slag
Without nitrogen	11.0	13.6	16.4
With »	22.6	23.2	23.8

Thus showing the superiority of basic phosphates on these plots.

The increases with phosphates however were not remunerative.

Molasses as manures. — During the three years over which the trials have extended the plots treated with molasses have given mean annual yields practically identical with those from untreated plots.

281 – **The Sugar Industry in Cuba.** — DEERR, NOEL, in *The Louisiana Planter and Sugar Manufacturer*,, Vol. LIII, No. 24, pp. 380-383. New Orleans, December 1914.

The Island of Cuba has the reputation of being the worst cultivated of all cane producing countries and at the same time it holds a preeminent position as the largest and cheapest cane-sugar producer in the world. This remarkable position is due the extensive system of cultivation practised, which is the only system of any economic value to Cuba under present conditions. The high price of labour renders the production of heavy crops unprofitable at ordinary selling prices, but the existence of virgin land with freehold ownership, summer rainfall without irrigation and the close access to market with small freight charges render extensive cultivation very profitable.

The cultivation consists of ploughing with oxen to a depth of 3 or 4 inches. Deeper ploughing would be much more expensive and cause injury by raising the infertile subsoil. In some of the deeper red soils it is very probable that deep ploughing would be highly remunerative. It is a peculiarity of Cuban practice to leave the trash or dry leaves of the cane on the fields from one year to another. This is very probably sound practice under Cuban conditions since it retains moisture in the soil and economises labour. It has the objection of retarding the growth of the ratoon crop, but it is open to question whether the systematic collection of the trash into alternate rows would increase the crop sufficiently to cover the extra cost of labour.

The possibility of developing an alcohol industry from the molasses and of thus obtaining a supply of power for cultivation purposes is suggested as a means of revolutionising Cuban agriculture. Owing to the drought

uring the winter months it is considered that irrigation would be of great alue, but no data are yet available to determine to what extent it would e of economic value. At present the use of fertilizers is not generally ractised and it would only appear to be necessary in the western part f the island where the soils are more exhausted. Manurial experiments re being conducted at various centres to determine to what extent ertilisers may be used.

82 -- **Cacao Experiments: Manuring and Cultivation, 1913.** — HARRISON, J. B., and BAYLEY, S. H., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VIII, Nos. and 2, pp. 40-44. Georgetown, Demerara, October 1914.

Manurial experiments carried out on cocoa trees during 5 years 1909-13) have furished the following results :

Plots	Yields in lbs. per acre			
	Wet cacao		Cured cacao	
	Yield	Probable error.	Yield	Probable error
os. 1, 4, 7, 11, and 16. No manure	5762	± 196	2080	± 71
» 3, 8, and 13. Heavily mulched	7482	± 289	2699	± 113
» 12 and 18. Sulphate of Ammonia	5440	± 426	1963	± 155
» 6 and 14. Superphaphate of lime and sulphate of potash	7492	± 460	2705	± 154
5, 10, and 15. Superphosphate and sulphate of ammonia	6560	± 485	2375	± 213
o. 9. Sulphate of potash and sulphate of ammonia	6208	± 596	2242	± 217
os. 2, and 17. Superphosphate, sulphate of potash and sulphate of ammonia	6801	± 271	2465	± 99

Taking into account the probable errors, the highest total yield of acao during the five years has been on the heavily mulched plots which ave a minimum increase of about 435 lbs. of cured cacao or about 84 lbs. er acre over the mean of the 5 control plots.

The value of this increase is about $ 52 and the cost of the mulching pproximately $66. On the other hand the application of sulphate of otash and superphosphate of lime, costing approximately $ 14 during the ve years gave a minimum increase of 400 lbs. of cacao worth about $ 50. he quick acting nitrogenous manure — sulphate of ammonia — somewhat ssened the yields both when applied alone and in conjunction with super-hosphate and sulphate of potash.

The results obtained in 1913, during which no manures were applied, owed that a residual effect remained from the previous years only in ne case of the mulched plots and those receiving both superphosphate and

sulphate of potash, whilst. where sulphate of ammonia had been applied the yields were lower than in the case of the unmanured plots.

Liming experiments carried out on 36 plots showed no beneficial effect during the five years.

The effect of decreasing the shade, improving the tillage, drainage and sanitation of cacao trees is seen in the results obtained from 2 acres of trees taken over by the Agricultural Department in 1910. During the last five years the yields have steadily increased from a mean of 1064 lbs. to 4494 lbs. of cured cacao. Further experiments on the reduction of shade were carried out in 1913 on the same plots.

The results were as follows :

	Per acre of 300 trees	
	No. of pods	lbs of pulp
Heavily shaded	5889	1204
Very lightly shaded	9546	1823

The writers consider that the removal of shade has a greater influence on the yield of the trees than the improvement in drainage and cultivation.

283 – **On the Transformation of Nitrogenous Substances during the Artificial Curing of Tobacco..** — BERNARDINI, L., in *Bollettino tecnico della coltivazione dei tabacchi* Year XIII, No. 5, pp. 288-299. Rome, September-October 1914.

The artificial curing of tobacco, invented by ANGELONI, may be regarded as the fusion of the two processes, curing and fermentation into one continuous process. The writer sets himself the task of investigating the changes that take place in the nitrogenous substances during artificial curing as compared with air curing, for the latter method, even after subsequent fermentation, does not succeed in giving good results in the case of fine native tobaccos.

The results of these researches were as follows :

1) The artificial curing process does not produce any changes in the proteid substance of the leaf.

2) In leaves cured by this process there are none of the soluble nitrogenous substances belonging to the amino-acids which occur in air cured leaves.

3) In the artificial curing and air curing processes alike, the basic nitrogen contained in the leaves corresponds exactly to that present under the forms of nicotine and ammonia.

The consumption of nitrogenous substance observed during artificial curing therefore takes place at the expense of the amino-acids which are completely used up, while the proteid substance and the nicotine remain unaffected.

MARKET GARDENING

284 – **The Effect of Sowing Seeds in a Hot-Bed on the Subsequent Vegetative Growth of the Plants.** — CURÉ and FOËX in *Journal de la Société Nationale d'Horticulture de France*, Series 4, Vol. XV, pp. 501-504, Paris, July-December 1914.

It has been known for many years that certain kitchen-garden plants when sown in a hot bed, make a dwarfed compact growth, while when sown

a cold bed or in the open, they become tall and bear flowers and fruit. This the case with cabbages, *Brassica chinensis*, turnips, chicory etc. The riters have investigated this difference of development in the above-entioned plants and also in carnations, and have observed that the roots the plants in a hot bed grow much less rapidly than of those sown in ıe open, or in a cold bed. Thus, the ratio between the total length of the ant and that of its root during the first period of growth is much greater the case of plants sown in a hot bed than in those raised under the other nditions. After two months this difference is no longer noticeable; ter, the exact reverse sometimes occurs. This excessive slowness in the owth of their roots does not prevent the total development of the plants the hot bed being more rapid. Their stems grow very quickly, and are ways longer than those of plants sown under other conditions at the same ate. The leaves of hot bed plants appear sooner, and the latter may ave already 2-4 leaves when plants in a cold bed or in the open have only ieir cotyledons developed; further, the leaves of plants raised in a hot ed grow with special rapidity and are often very long.

5 – **The Varieties of Apples Best Suited to British Columbia.** — WINSLOW, R. M., (Provincial Horticulturist for B. C.), in *The Canalican Horticulturist and Beekeeper*, Vol. XXXVII, N° 11, pp. 257-258. Peterboro, Ontario, Novembre 1914. FRUIT GROWING

The commercial apple industry of British Columbia is a development the last decade. The census of 1900 showed about 6000 acres of fruit the province; that of 1910, 33 606 acres; and that of 1913, 38 196 acres. he new development is mainly in the interior.

As the choice of varieties must follow climatic conditions, the writer as commenced by investigating these. First, the length of the growing ason; this corresponds with the period during which the mean temperature over 43° F. and varies in different tracts from 175 to 240 days. Thus at ancouver it is 230 days; on the Hood River 240 days. The second consi-eration is the number of heat units, *i. e.* the sum total of heat during ıe season expressed in heat units, one heat unit representing one degree er day for each day of the growing season. Thus the sum totals of heat nits are for Hood River an average of 15 315 heat units; for Vancouver 2 607. Another important consideration is the temperature for the ottest six weeks of the year. The writer having collected such data for l the principal apple-growing tracts on the Continent especially those of ıe Pacific Northwest, he set out to determine the range of particular arieties; particularly the Yellow Newton, Spitzenberg, Winesap, Jo-athan, Wagner, Mc Intosh and Northern Spy.

The Yellow Newton is notably a variety of limited adaptability and r that reason has not been recommended for planting in British Columbia.

The Spitzenberg requires somewhat similar climatic conditions to the ellow Newton though it is doing well in some western irrigated districts. districts such as Spokane with 216 growing days, 12 620 heat units and six hottest weeks temperature of 68.6° F., the trees are not so produc-ve, the fruit not so large, nor so well flavoured, nor of so high quality.

The principal interior districts which have temperatures much like tha of Spokane are obtaining similar results.

The variety Winesap requires a growing season of about 225 days, total of not less than 13400 heat unit and a six hottest weeks temperatur of 70° to 72° F. With shorter or cooler seasons the fruit lacks in size, colou and quality. The writer does not consider the popularity enjoyed by thi apple in British Columbia quite justified and would only recommend it plantation on a large scale in the hotter tracts such as those of the lowe Okanagan Lake, Similkameen Valley and Kamloops.

The Wagner variety seems well suited to the dry belt areas in whic the Jonathan is succeeding. Its early bearing and productiveness are i its favour and it apparently requires the very conditions found throughou our interior sections in which it, next to the Jonathan, is the most largel planted variety. Water core has given considerable trouble and its con trol by cultural methods is not yet attained.

The Mc Intosh Red is of Canadian origin though very popular no in Vermont and in the Bitterroot Valley of Montana ; it thrives excellentl in its native home with a growing season of 195 days, 11 052 heat unit and a six hottest weeks temperature of 68.2° F. These conditions are foun in both the irrigated and non-irrigated fruit districts of the interior. N other well known variety seems to be so admirably adapted in this respec as the Mc Intosh, and it may yet become our most popular apple.

The great unsolved problem in British Columbia is to find a suitabl apple with good keeping qualities. The tree must also be hardy, vigorou and productive. A great number of varieties grown successfully in Grea Britain and Australia are now being tested with the view of finding on that will do well in British Columbia.

286 – **The Sagrantino of Montefalco, near Perugia.** — Luigi Fronzi in *L'Itali Agricola*, Year 51, No 12, pp. 549-552. Piacenza, December 15, 1914.

The Sagrantino of Montefalco is a vine peculiar to the district o Montefalco which extends over a series of gently sloping hills, from 130 to 1600 feet above sea level, along the fertile plain of Spoleto. The soil i calcareous clay, or calcareous loam, the subsoil being at times deep an at others mixed with gravel. Nothing is known with certainty as to th origin of this vine which is only now extending slowly to the surroundin districts. It is a vine which bears little fruit and requires rich an complete fertilisers, these defects explain its limited distribution, but i possesses important properties which would render advisable its mor extensive cultivation.

The following is a short description of the Sagrantino. The plan is very vigorous and of imposing habit. The stem is of average size an grows erect, the canes are hard, have little pith, a reddish-yellow corte full of striations, internodes of average length and very prominent node The buds are medium-sized and ovoid, the tendrils are not numerou woody, discontinuous and bifid. The vine shoots and flowers late. Th leaves are somewhat large, variable in shape; the upper surface is glabrou the lower tomentous. The bunches of fruit are of medium size, elongated

emi-loose with long, thick herbaceous pedicels which remain the same even fter the grapes are ripe. The grapes are of unequal size, of spherical orm and dark ruby-red ; the skins are pruinose, thick, leathery, the pulp s hard, firm, very sweet and aromatic . The pips are usually two in number. The grapes keep well and are resistant to pathogenic agents. The vine made from these grapes is really remarkable and the fact is not without ignificance that, while in the same district, and in the same market, common grapes are sold at 6*s*. to 7*s* 3*d* per cwt, the Sagrantino fruit fetches rom 12*s* to 14*s* per cwt. even in the best seasons.

The wine is mellow and generous when made with sufficient care, t is clear and dry, of a fine bright ruby colour and suitable for fine desert wine. Most of what is made however, is used for blending with red vine in the proportion of from 10 to 15 per cent.

It is interesting to compare the percentage of glucose and the acidity f the must of Sagrantino with that of the vines most commonly cultivted in the same district.

	Sugar in 100 cc. of must	Total acidity as tartaric acid per 1000
	—	—
Sagrantino	21	28.9
Sangioveto	17	30.1
Montepulciano	17	29.1
Canaiuolo	14.2	27.6
Trebbiano	14	36.2
Malvasia	17	30.3

87 – **New Hybrid Vines, European × American.** — PICCHIO, G., in *Il Coltivatore*, Year 60, No. 32, pp. 422-425. Casale Monferrato, November 20, 1914.

Recently, Prof. PERSI has produced a series of hybrid vines, European × American, with a view of obtaining vines which, while possessing a high egree of resistance to phylloxera, might at the same time have a well eveloped grafting affinity with the best Italian varieties (Piedmontese ines) and adapt themselves well to the climate and soil of Upper Italy.

The first hybrids, produced in 1910, show great vegetative development and will be grafted this year with Piedmontese varieties to test their rafting affinity. They will then be planted in phylloxera infested soil n order to observe their resistance to the parasite.

The first series of Prof. Persi's hybrids included the following varieies :

Year 1910	Lambrusca	×	Rupestris du Lot.
» »	Lambrusca	×	Berlandieri.
» »	Grignolino	×	Berlandieri.
Year 1011	Lambrusca	×	Berlandieri × Riparia 157-11.
» »	Freisa	×	Rupestris du Lot.
» »	Barbera	×	Rupestris × Berlandieri 301 B.
» »	Barbera	×	Rupestris metallica.
Year 1912	Cortese	×	Rupestris du Lot.
» »	Cortese	×	Berlandieri × Rupestris 301 B.
Year 1913	Barbera	×	Rupestris du Lot.
» »	Lambrusca	×	Berlandieri × Riparia 34 E.
» »	Lambrusca	×	Berlandieri × Riparia Persi No. 1.
» »	Cortese	×	Berlandieri × Riparia 157-11.

The Lambrusca or Croetto vine which is very common in the provinc of Alexandria, and especially in lower Monferrato, is the variety predomin ating among the European vines chosen by Persi. He selected it with th double aim of having a very vigorous productive variety with great adapt ability to grafting. It is in fact well-known that this vine is ver vigorous, grafts easily and grows well over a wide area. The product obtained by crossing this variety have proved very vigorous.

FORESTRY

288 – **The Role of the Aspen in the Reforestation of Burnt Areas on Mountains i Arizona and New Mexico.** — PEARSON, G. A., in *The Plant World*, Vol. 17, No. pp. 249-260, + 2 figs. Tucson, Arizona, September 1914.

A characteristic feature of the timbered mountains in Arizona an New Mexico at altitudes above 8000 feet is the occurrence of extensiv burns. Most of these areas have grown up to quaking aspen (*Popul tremuloides*), but extensive areas are practically bare. Douglas fir (*Pseud tsuga taxifolia*), white fir (*Abies concolor*) and Engelmann spruce (*Pice Engelmanni*) thrive in the shade of the aspen and eventually overtop reestablishing the original association or forest type. On the burn areas not occupied by aspen or oak brush, which may take the place o aspen, coniferous reproduction is usually deficient.

The absence of aspen on adjacent areas is difficult to explain. It propagated rapidly by means of suckers, but since it is extremely intoleran of shade, the prior establishment of other vegetation may preclude it reproduction.

The failure of conifers to establish themselves in the absence of th aspen or other brush wood suggested an investigation to determine th conditions favourable to reafforestation. This has been carried out a the Fort Valley Experiment Station since 1911. Direct seeding gave n results owing to the ravages of rodents and other causes. In selectin the planting plots for a comparison of results in aspen thickets and oper ings, absolute uniformity with respect to all physical conditions could no be obtained owing to the reaction of the aspen upon the habitat. Th effect of the aspen upon the establishment and growth of Douglas fi was studied by comparing the percentage of loss and injury in aspe thickets and in openings, supplemented by a study of the physica factors.

The results furnish abundant evidence of the superiority of the asper covered areas over the openings. The dead or injured plants in the ope areas almost invariably have the appearance of suffering from drought. Th tops turn brown and usually the entire plant dies, though plants which begi to fail toward the close of the dry period frequently revive after the begi ning of the summer rains. The records of the humidity of the soil and th rates of evaporation at different times throughout the investigation lead t the conclusion that the rate of evaporation is a more influential facto than the soil moisture. As shown in the open plots in 1913 heavy loss may occur in spite of the presence of an abundant moisture supply in th soil, if transpiration is not controlled. It is concluded that aspen stand despite the fact that the trees and the luxuriant undergrowth use u

a large portion of the soil moisture, create conditions more favourable to the establishment of planted Douglas fir than are found in open situations.

289 – **The Resin Industry in Spain.** — ITURRALDE Y ELORRIETA in *Revista de Montes*, Year XXXIX, No. 111, pp. 3-11. Madrid, January 1915.

The resin industry is of considerable economic importance in Spain. According to data in *Noticias sobre el pino negral y la industria resinera española*, the yield of resin was estimated at 17 ½ million lbs. in 1888, the year of publication of this memoir. During the next 10 years there was no increase in the yield. The " Unión Resinera Española " produced nearly 4 million lbs. of turpentine and 14 million lbs. of colophony in 1898. Since then, the yield has increased rapidly and the " Unión Resinera Española " records the yields given in Table I for the quinquennial period 1909-1912 :

	1908	1909	1910	1911	1912
	lbs.	lbs.	lbs.	lbs.	lbs.
Turpentine	10 328 057	10 257 248	10 423 224	9 870 911	10 959 571
Colophony	34 759 222	33 884 367	33 589 172	35 747 628	37 082 445
Various products . .	166 860	208 185	217 321	155 195	69 426
Total . . .	45 254 138	44 349 779	44 229 704	45 773 734	48 111 442

The total value of the yield of resin in Spain during the above period reached over 2 million pounds . The greater part of the product is exported, only a small quantity being consumed in the country.

Table II indicates the exports of resinous products in 1910, 1911, 1912 taken from the Customs Returns of Spain.

	Weight in lbs.			Value in £		
	1910	1911	1912	1910	1911	1912
Turpentine	8 421 343	8 106 092	7 237 064	2 530 264	2 435 545	2 174 438
Resin	22 568 903	19 468 108	25 067 737	1 228 445	1 061 896	1 364 513
Total . . .				3 758 709	3 497 441	3 538 951

The average annual value of the exports is therefore £3 599 167.

The chief countries importing Spanish products are Germany, England, Switzerland, Australia and even the United States, which imports clear colophony. On these markets Spain has to compete with France and the United States whose production of resin and resinous matter is 4 and 20 times greater respectively.

LIVE STOCK AND BREEDING.

HYGIENE

290 – **Diseases of Live Stock in England in 1913.** — *Board of Agriculture and Fisheries, Annual Report of the Chief Veterinary Officer for the Year* 1913 (Cd. 7423), 44 pp. London, 1914.

During the year 1913, two outbreaks of *foot-and-mouth disease* occurred in England, both of which were promptly dealt with by the veterinary officers of the Board of Agriculture and stamped out. The cause of the outbreaks remained undetermined ; in neither case was there any evidence to incriminate imported food or litter — in fact in one case the possibility was excluded, as no food imported from abroad had been used on the farm.

Out of 14 044 reported outbreaks of *swine fever* 2573 were confirmed, representing a decrease of 347 outbreaks compared with 1912. During the year three officers of the Board were sent to Holland and to Hungary to collect information regarding the process of artificial immunisation in those countries. The report presented by these officers cannot be said to have materially lessened the difficulties in the way of making use of methods of artificial immunisation which were laid before the Swine Fever Committee in 1910 ; but subsequently, on the advice of this Committee, the Board decided to conduct a series of trials on infected premises subject to the consent of the owner of the premises. *Swine erysipelas,* which is frequently reported as swine fever, also caused severe losses to the pig industry, a table giving the monthly incidence of reported cases of this disease showed that it occurs most frequently during the summer months and chiefly amongst fat pigs, but also amongst stores and young pigs.

The outbreaks of *glanders* were reduced from 172 in 1912 to 162 in 1913, but the number of animals attacked increased from 315 to 438 in the same time ; this increase is accounted for by the discovery of new centres of infection. The outbreaks of *anthrax* confirmed during the year were 594, being 149 less than in the previous year ; the death-rate per outbreaks was 1.01 per cent and in 80 per cent of the cases infection was traced to imported goods.

The inspection of Irish stock instituted to guard against the introduction of foot-and-mouth disease into England brought out the fact that many sheep affected with *scab* were arriving from Ireland. These must partly account for the fact that the outbreaks of scab in Great Britain still amounted to 235 in 1913, a reduction of only 66 on the number of outbreaks in 1912. Cases of *parasitic mange* and of *tuberculosis* occurred to the numbers of 4647 and 4720 respectively.

The work done on *epizootic abortion* has been dealt with under a different report (1). Experiments on the artificial immunisation of cattle were started with groups of herds in defined areas.

(1) See *B.* May 1914, No. 446.

An investigation was also commenced in connection with a disease of sheep known as " scrapie " (2), which occurs on the borders of Scotland and England and shows signs of becoming serious.

291 – **The Bursati Disease of Horses in India.** — HOLMES, J. D. E., (Imperial Bacteriologist) in *Memoirs of the Department of Agriculture in India*, Vol. II, No. 5, pp. 119-153 + 5 Plates. Calcutta, September 1914.

A study of the literature on this subject shows that considerable confusion exists regarding the identity of bursati in India with " leeches " in America, " swamp cancer " in Australia and other affections described as " summer sore ", granular dermatitis and parasitic fibromata, etc. According to some authorities these latter affections are held to be connected with the presence of nematode embryos.

There is some similarity in clinical aspects between bursati and leeches, but the other affections: summer sore, dermatitis, etc. are quite distinct. The bursati lesion is characterised as a round or oval shaped sore with regular clear cut edges which are slightly raised and hard and callous to the touch. The fibrous formation of the sore extends to the subcutaneous and muscular tissue. The surface remains dry and only spreads when exposed to irritation. Beneath the surface small hard granules of a yellow or grey colour occur and are known as " kunkur " bodies.

No evidence was obtained of the presence of filarial embryos in any portion of the bursati lesion. On two occasions however a single filarium was seen in blood smears from a freshly excised tumour. Examination of the macerated unstained material from various parts of the tumour and from kunkurs showed the presence of a fungus mycelium similar to that reported in leeches ". This fungus was identified by Dr. Butler, Imperial Mycologist, as *Sporothricum minutissimum*. The evidence therefore suggests that the disease is a mycosis somewhat resembling the *Sporothricosis* of the horse and mule described by Carougeau in Madagascar. Innoculations with fresh material from the sores and cultures of the fungus failed, however, to produce any of the symptoms of the disease.

Local treatment consists of the excision of the tumours and the application of dry antiseptics such as crystalline red oxide of mercury. Arsenic alone or in combination with atoxyl was administered with partial success, and encouraging results have recently been obtained by administering arsenious acid in doses of increasing strength.

292 – **The Cure of Sterility in Cows.** — REINHARDT, R., in *Monatshefte für Praktische Tierheilkunde*, Vol. XXV, Parts 11-12, pp. 529-545. Stuttgart, 1914.

From the experience he acquired as Director of the hospital of the Veterinary College at Stuttgart, the writer recommends the following methods for curing the different diseases causing sterility in cows. He does not deal with diseases which have a general cause, but limits himself to those affecting the reproductive system.

(2) See *B.* Jan. 1915, No. 66. (*Ed.*).

Internal curative methods.

1) *Remedy for deficiency, excessive brevity or weakness of heat*; cantharidine, either administered in milk in the proportion of 4-6 gms. daily, or as a tincture (20 gms.). Joimbin gives, as a rule, good results; but its high price prevents its general use.

2) *Against too violent, or too frequent heat*: bromide of potassium, which however only has effect for the period at which it is given.

3) *For chronic, catarrhal or purulent endometritis:* copaiba balsam and oil of turpentine mixed in equal portions. Two spoonfuls of this mixture are to be taken fasting in milk every morning for 4 to 6 weeks. For the first 7 or 8 days, the catarrhal flux increases and is sometimes attended by pain, but it gradually diminishes and ceases. After 4 to 6 weeks, as a rule, the animal is cured and shows the normal signs of heat and conception. The milk does not acquire any turpentine odour from this treatment. Naturally the internal treatment is still more efficacious if accompanied by local treatment.

Local or surgical methods of treatment.

1) *Failure in conception* was in some cases successfully treated by washing with a 0.5 per cent solution of bicarbonate of soda before mating, especially where conception was hindered by an excessive accumulation of secretion at the base of the vagina; this was dissolved and removed by the washing. This treatment does not act by changing the acid reaction of the secretion (which would destroy the spermatozoa) into an alkaline one, for only in one of the 98 cases examined by the writer was the reaction of the secretion acid.

2) *For the treatment of ovarian cysts or of persistent or hypertrophic corpus luteum*, Profs. Zschokke, Hess and others have recommended the crushing of the cysts of the ovaries and the enucleation of the *corpora lutea* from the rectum. Thousands of cows have been treated successfully in this manner. The writer has also generally had good results from the enucleation of the *corpora lutea*. The crushing of the ovarian cysts was often, but not invariably, successful, for in spite of repeated treatment, the cysts reformed in some cases. Further, sometimes it was impossible to decide whether the swelling was a cyst, or an abscess on the ovary in which latter case peritonitis was caused and it was nearly always necessary to kill the animal. In addition, the carrying out of this operation is not without risk, therefore the writer prefers the method proposed by Albrechtsen at the Veterinary Congress held at the Hague in 1909. This consists in taking hold of the cervix of the uterus with forceps, drawing it back and fixing it in this position; introducing a catheter into the canal of the cervix and washing it out with a solution of soda or dilute alcohol, at the same time massaging the uterus from the rectum and subsequently injecting a dilute solution of iodized potassium iodide diluted in the proportion of from 1 :3 :97 to 1 :3 :17.

Special care should be taken in the treatment of the changes in the cervical zone: the inflamed and thickened mucous membrane is cleansed with a piece of cotton-wool steeped in alcohol, and then painted with a solution

of iodine . If there are polypi, or other tumours, on the mucous membrane, these are removed with scissors. In the case of cysts, Albrechtsen recommends that they should be crushed in addition of the treatment of the uterus. He, however, does not advise the enucleation to the *corpora lutea* as he considers it unnecessary. The writer agrees with Albrechtsen in regarding the presence of catarrhal or purulent endometritis whether accompanied, or not, by alterations in the cervix of the uterus, or of the ovaries, as the most frequent cause of sterility, and in considering the diseases of the uterus and its cervix as primary and those of the ovaries as secondary, for the latter disappear when the former are cured. This has often been proved by the writer when using Albrechtsen's method, which is one he warmly recommends as the best existing. He, however, draws attention to the fact that in very severe cases, it may be necessary to apply it repeatedly and that such treatment will not be efficacious if delayed too long, viz., until, as the result of obstinate endometritis, the uterine mucous membrane has been destroyed, or calcified.

The writer used the Albrechtsen method also for sterile cows which were healthy and possessed reproductive organs showing no trace of alteration or anomalies and often succeeded in curing the animals. He therefore concludes that inexplicable cases of sterility are due to latent endometritis.

This article is accompanied by a bibliography of 60 works.

293 – **The Intradermal Test for Tuberculosis in Cattle and Hogs.** — HARING, C. M., BELL, R. M. — *University of California Publications, Bulletin*, No. 243, pp. 154. Berkeley, Cal., March 1914.

The intradermal test with tuberculin (injection into the deeper layers of the skin) has been tried on a large scale for the detection of tuberculosis in cattle and pigs, and has proved a useful adjunct to the usual subcutaneous procedure; small, latent or arrested lesions will sometimes react to the intradermal and not to the subcutaneous tests, but considerable experience is required to interpret the local swellings produced. Intradermal injections are specially well adapted to the testing of swine.

294 – **Coccidiosis in Poultry and Game Birds.** — FANTHAM, H. B., in *The Journal of the Board of Agriculture*, Vol. XXI, No 10, pp. 889-899. London, January 1915.

Coccidiosis is a disease caused by a minute animal parasite *Eimera* (*Coccidium*) *avum* that lives and multiplies within the lining of the alimentary canal of poultry and game birds and causes considerable losses in England and other parts of Europe and in America. The chief hosts infected in England are fowls, turkeys, pigeons, geese, ducks, pheasants, partridges and grouse. A disease due to an allied organism occurs in rabbits and hares producing affections of the gut and liver, but this parasite is not communicable, to birds. Coccidiosis is most common among young birds, but mature birds may contract the disease with fatal results. The parasite having been picked up by the bird in the oocyst stage of its life cycle, penetrates into the wall of the intestine and enters upon a period of active asexual reproduction causing acute inflammation and partial destruc-

tion of the mucous membrane. The bird eats ravenously but looses weigh and condition and becomes markedly anaemic while the droppings have characteristic fluid and pale appearance. Death is often very sudden After a time the parasite enters upon the sexual stage of its life histor with the eventual formation of extremely resistant oocysts which pas from the body. If the infection has not been too acute, the gut linin may be able to regenerate and the bird begins to recover. Some bird which have apparently recovered, actually remain infected though th parasites present are relatively few and do not seem to cause the hos much inconvenience. These birds are chronic cases which serve as a insidious means of spreading the disease to chicks they may rear or to othe birds with which they may associate.

To prevent the spread of the disease all infected birds and thei droppings should be burnt, and infected soil should be treated with fres quicklime and turned over to a depth of a foot and a half. No rearin should be done on ground known to have been infected. Considerabl success has been obtained by given affected birds a solution of fifteen grain of catechu dissolved in one gallon of water ; the birds drink it greedil and rapid improvement generally follows; the treatment is usually onl necessary for about ten days.

ANATOMY AND PHYSIOLOGY

295 – **The Relation Betwen the Transformation of Energy and Nitrogenou Metabolism during Hunger.** – HARI, PAUL, (Aus dem physiologisch-chemische Institut de Universität Budapest), in *Biochemische Zeitschrift*, Vol. 66, Parts 1-3 pp. 1-19, 20-47. Berlin, 1914.

I. According to Rubner's Law of Surfaces, the heat production o a warm-blooded animal is not proportional to its mass but to the surfac area of its body. The quantity of heat per unit area of skin is almost equa for all warm-blooded animals, and, according to Erwin Voit, it is 1000 K (large calories) per square metre of surface in the case of man, pigs, dogs geese and fowls, and 800 K in the case of rabbits. Some authorities how ever do not accept Rubner's Law unconditionally and it is therefore neces sary to carry out more precise experiments. The various authorities car ried out their experiments at very different temperatures; since for a differ ence of 1° in the external temperature, varying percentage differences in th quantity of heat produced are obtained according to the temperature o the experiment, therefore the different results cannot be corrected to given standard temperature. This question therefore can only be resolve satisfactorily by means of experiments on animals which have been fe uniformly during a long preliminary period and which are in similar stage of hunger ; the experiments must also be carried out at approximately th critical temperature. The minimum quantity of heat energy necessar for the animal's maintenance is also determined under these conditions.

These conditions were fulfilled in 17 series of experiments with sta ving dogs carried out by the writer during 1909-1913. Most of the exper ments were carried out at a temperature close to the critical temperatur at about 28° C. The transformation of the energy into heat was determine directly in a respiration calorimeter or indirectly by the determination

the protein and fat metabolism. Thirteen short-haired dogs were used in these experiments from the results of which the writer draws the following conclusions:

1. The minimum quantity of energy per unit area required to be transformed in the maintenanee of the life of the animal is not uniform during the first days of fasting (1st to 8th), and varies between 700 and 1000 K.

2. The minimum quantity of energy, required to be transformed into heat is independent of the size of the body of the fasting animal, and depends directly upon the quantity of albuminoid matter decomposed.

3. The increase in the quantity of energy transformed into heat, in addition to that produced by the decomposition of proteins, originates in a greater combustion of fatty matter, which may also be considered as a specific dynamic action of the protein decomposition.

4. This action in fasting animals probably indicates that the products of protein decomposition have a definite chemical action on the fats, causing them to be consumed at a greater rate.

II. — It has already been established that in animals maintained fasting during a prolonged period, the quantity of energy transformed into heat, per unit area of body surface, diminishes more or less rapidly. As most of the experiments were conducted below the critical temperature the writer was desirous of repeating them at a temperature nearer the critical temperature and with determinations of the heat produced by direct methods or by means of the decomposition products of the animal organism. To this end, dogs, after a preliminary period of fasting, were put on to a milk diet insufficient to their needs. The results obtained were summarised as follows :

1. If a fasting dog is fed daily with a quantity of milk insufficient to its needs, the daily output of chemical energy transformed into other forms of energy, may either increase or decrease ; it shows a slight increase in those animals which, during the preceding period of fasting, underwent a relatively small loss of albuminoid, whilst animals with a relatively high loss of albuminoid matter showed a decrease in the amount of energy transformed into heat.

2. The specific dynamic action of milk can also be seen in animals which have suffered a sufficiently heavy loss of albuminoids ; this loss causes a distinct decrease in the minimum quantity of energy required to be transformed for maintenance.

296 – **The Influence on Growth of Rations Restricted to the Grain of Maize or Wheat** (1). — HART, E. B., and MC COLLUM, E. V., (University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XIX, No. 3, pp. 373-395, + 11 Diagr. Baltimore, Md., November 1914.

Previous researches on herbivora have shown the inability of a "balanced" ration from the wheat plant to maintain a complete life cycle, while a balanced ration from the maize plant served this purpose admirably. The experiments have been repeated with the same diets fed to pigs and rats.

(1) See also *B.* Jan. 1915, Nos. 72-73-74. *(Ed.)*

Strong healthy Poland China pigs of 40 to 70 lbs. weight were chosen and confined indoors. Distilled water was used throughout the work and the rations were fed *ad libitum*, the protein content always being raised to 14-15 per cent by the addition to the grain of a concentrate from the same kernel. The details of the rations are as follows:

Ration 1. — 70 lbs. of maize meal; 30 lbs. of gluten feed.

Ration 2. — 70 lbs. of maize meal; 30 lbs. gluten feed; potassium monophosphate 323 grams; calcium lactate 513 grams.

Ration 3. — 97.5 lbs. wheat meal; 2.5 lbs. wheat gluten.

Ration 4. — 97.5 lbs. wheat meal; 2.5 lbs. wheat gluten; potassium monophosphate 259 grams; potassium citrate 36 grams; calcium lactate 684 grams.

Ration 5. — 88 lbs. wheat meal; 10 lbs. wheat bran; 2 lbs. wheat gluten.

Ration 6. — 88 lbs. wheat meal; 10 lbs. wheat bran; 2 lbs. wheat gluten; calcium lactate 276 grams; potassium citrate 338 grams; magnesium citrate 317 grams.

Ration 7. — 27 lbs. maize meal; 30 lbs. ground oats; 30 lbs. of middlings; 13 lbs. gluten feed.

Ration 8. — One-half maize ration No. 1; one-half wheat ration No. 3.

Ration 9. — 90 lbs. wheat meal; 10 lbs. oil meal.

Ration 10. — 30 lbs. maize; 30 lbs. ground oats; 30 lbs. middling; 10 lbs. oil meal.

In ration 6 the mineral mixture added was designed to furnish just sufficient quantity of bases to maintain the ration at the neutral point, since all grain rations have a preponderance of acid over basic elements. Most of the experiments were continued into the autumn. The weekly growth records were plotted in the form of curves for the different rations. The normal growth curve for pigs was taken from the results of experiments conducted at American Experiment Stations with pigs consuming a variety of foods and natural water. These records give a daily increase in body weight of 0.9 lb. up to a weight of 300 lbs. after which the rate of gain decreases.

The records also show that the maize grain ration alone does not induce growth, but when a suitable salt ration was added the rate of growth approximated to that of the normal curve. A mixture of grains without added salts was incapable of inducing continuous growth. It is therefore concluded that the development of animals depends not only on the food material in the forage but also on the substances present in the water and probably also those present in the soil. Pigs fed on ration 1 with natural water and allowed only limited range without grass, developed normally, as also did the pigs under similar conditions but recieving a mixture of equal parts of maize, oats and wheat. A ration of wheat grains without salts gave no appreciable increase. The additional salts gave an increase in growth which still remained below the normal increase, and symptoms of malnutrition soon developed. One pig fed on wheat grain plus a mixture of salts did not increase in weight beyond 124 lbs.; when milk, maize and natural water were added to the ration, the animal continued to increase in weight but not in height.

It appears from these experiments that the bad effects of rations consisting exclusively of wheat grains cannot be entirely attributed to the lack

of an element necessary for growth, but also, to some extent, to the presence of some toxic substance contained in the grain or produced in the animal organism after consumption. To test this point a second series of experiments was carried out. In order to eliminate the possibility of a lack of supply of all the constituents necessary for growth, butter fat was added in addition to the salts. The further possibility of inadequate proteins was met by the addition of casein to the wheat ration equivalent to 18 per cent of the total protein and 2.5 per cent of the ration. Distilled water and confinement to pens were strictly followed as in the previous experiments.

The most notable result was obtained by replacing the gluten of the grain by casein thus suggesting that the casein supplied the amino-acids necessary for the rapid growth of tissue, which are absent from gluten. This may have been the first effect but there certainly must have been secondary influences accompanying rapid growth. A pig fed on wheat, gluten, and salt does not suffer from starvation, but the paralysis, blindness, roughness of coat, and general debility accompanying a long continued use of this ration all indicate an inherent toxicity in the wheat kernel. The addition of casein very probably provides a more suitable mixture of amino-acids which then makes possible a rapid growth of tissue, and this in its turn increases the resisting powers of the animal. The decided improvement in nutrition which results from the addition of casein and salts appears to suggest the presence in the wheat proteins of excessive amounts of certain amino-acids which, under the peculiar circumstances resulting from the wheat diet, injure the cells.

The addition of butter to the ration of grains and salts improves the rate of growth, but does not restore it to the normal, as when both butter fat and casein are added. The effect of butter fat is in marked contrast to the poor results obtained with maize oil.

Conclusions.—1. When swine are restricted to a diet of maize meal and gluten, little or no growth can be secured, but with an addition of salts to make the entire ash content of the ration very similar to that of milk, growth approximating to that of a normal curve was obtained to at least 275 lbs. live weight. These results are not in harmony with the theory that the failure of pigs to grow on maize alone is due entirely to the incomplete nature of its protein content.

2. Pigs restricted to distilled water and mixed grains did not show normal growth. This emphasises the very great importance of the mineral side of a ration, and of the unknown factors in the natural environment of the species such as, soil rooting, natural water, etc.

3. When the wheat kernel supplied all the nutrients, growth was again limited in both swine and rats, but when the salt content was modified to resemble milk some growth could be secured, followed by partial paralysis and general decline. Correcting the mineral content of the wheat kernel with salts induces a certain amount of growth but the benefit is only temporary.

4. The addition of salts and butter fat to the wheat kernel improved the growth curve, though a normal curve was not secured. However the

animals remained vigorous and strong though partial decline occurred i some individuals. The addition of casein to the extent of 2.5 per cent o the ration gave a normal growth curve in both rats and mice.

5. Rations may contain as much as 80 to 90 per cent of whea without bad effects when supplemented with milk or egg yolk. Norma reproduction as well as normal growth have been secured with such rations

297 – **The Value of the Proteins of Cereal Grains and of Milk for Growth i the Pig, and the Influence of the Plane of Protein Intake on Growth.** – Mc COLLUM, E. V., (University of Wisconsin) in *The Journal of Biological Chemistry* Vol. XIX, No. 3, pp. 323-333. Baltimore, November 1914.

During recent years numerous researches have been made concernin the relative quantities of amino-acids produced by the hydrolysis of pro teins. It is now generally accepted that the similarity in the composition of the food proteins with respect to their amino-acids and those of the bod which they are to replace determines the relative values of the indivi dual proteins as animal foods. It has been proved that wide difference in the chemical nature of the proteins exist; but it is difficult to obtai experimental evidence that comparable differences in the nutritive value of the individual proteins also exist. Such evidence involves the attain ment of growth in young animals fed on rations made up of chemicall pure food stuffs. The investigations of the writer and of other authoritie at a later date have established the fact that certain individual protein from both animal and vegetable sources are capable of supplying every thing necessary for prolonged growth. Other proteins, as gliadin of whea are sufficient for maintenance but not for growth; while others, as gelati or zein can serve only in part to replace the nitrogen lost through endo genous metabolism and are incapable when fed singly, of inducing growt in young animals.

This paper is the second report of a series of experiments which hav been in progress during the last four years with a view to obtaining quanti tative data on the relative values of the protein mixtures occurring in na tural foodstuffs.

Vigorous young pigs were fed during a preparatory period, wit starch, agar-agar, and water. During the experimental period the starc was replaced by grain with or without the addition of starch or a protei concentrate. The total nitrogen was determined either in the urine o in the excrement. The quantity of protein fed was based on the quantity of creatinine excreted during the preliminary starch period, assuming tha the endogenous upkeep of the pig required 5.5 times the nitrogen dail eliminated as creatinine. The energy content of the rations was in mos of the experiments kept very near 100 calories per kilo per day.

The conclusions drawn from the experiments are as follows: Wit moderately low protein intake (6.6-10 per cent), the rate of nitrogen re tention is influenced by the amount of food in proportion to the metaboli ing tissues of the body and in some degree by the excess of total energ consumed over the maintenance needs of the body. When the energ supply is generous (100 calories per kilo) the rate of nitrogen retention a

expressed in percentage of ingested nitrogen is not much influenced by the plane of protein intake in quantities above 10 per cent of the ration. In experiments in which the protein amounted to 41 to 57.86 per cent of the ration, the maximum possible per cent of the ingested nitrogen continues to be retained for growth.

The results all point to the belief that in the young pig the growth impulse is so great that the synthesis of body protein is effected at the maximum rate possible with the particular mixture of amino-acids yielded by the food proteins. If this be true the figures for the percent of the absorbed nitrogen retained for new growth indicate the degree to which the amino-acids of the foods can be recombined into tissue proteins and they represent comparative numerical values for proteins from different sources. There is very little difference in the value for growth of the protein mixtures contained in the three cereal grains, wheat, oat and maize kernels. Of the total nitrogen ingested in one of these three forms, a maximum of 23 to 24 per cent can be retained for growth. The rate of retention of nitrogen, in all cases where a sufficiently high proportion of protein was fed, was limited by the chemical make-up of the food proteins, and not by the physiological capacity of the animals to grow. The physiological limit of growth capacity was not attained in the experiments in which all protein was derived from cereal grains. There is no reason to doubt that the protein mixture occurring in either the wheat, oat or maize kernel is chemically inferior to casein alone or to the protein mixture afforded in milk. The data seem equally convincing that the protein mixture in each of these grains is singly adequate chemically for the complete formation of the specific proteins of the pig's body, although quantitatively the possibility of this conversion is relatively low.

Therewas always a significant rise in the amount of nitrogen eliminated as creatinine in all cases where a fairly large amount of nitrogen was retained for growth. This appears to strengthen the evidence that all the cleavage products of proteins necessary for the construction of metabolising tissue in the animal were supplied by the proteins of each of the cereal grains employed.

298 – **Acidosis in Omnivora and Herbivora and its Relation to Protein Storage.** — STEENBOCK, H., NELSON, V. E., and HART, E. B., (University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XIX, No. 3, pp. 399-419. Baltimore, Md., November, 1914.

It is now fully established by experimental work that omnivora and carnivora can effectively protect themselves against acidosis (excess of acid over bases) in the tissues by the production of ammonia, but that the herbivora have no such power or at least only to a limited extent. The writers have conducted experiments with pigs and calves to investigate this question. The ammonia content of the urine was determined after feeding on grain alone or grain supplemented with basic substances in the case of pigs, and, in the case of calves, on whole milk alone (of which the basicity is 183 cc. of normal solution per 100 grs. dry matter) or milk supplemented with varying quantities of normal hydrochloric acid solution.

The conclusions arrived at are as follows :

Acid rations fed to swine or calves cause a rise in the urinary ammon and a corresponding decrease in the output of urea. Presumably on normal level of protein intake a part of the ammonia, produced either the intestine or liver, combines with acids and is excreted as the salts these acids. This power to help to maintain neutrality by the productio or use of ammonia is apparently very general in all mammals. The pr duction of ammonia, under conditions of exogenous protein metabolism does not occasion an increased nitrogen excretion or an interference wit protein storage.

In herbivora (calves), approximate endogenous nitrogen metabolism accompanied by mineral acid ingestion, likewise occasions a rise in urinar ammonia, but does not, on the level of acid used, cause a rise in protei catabolism, as has been observed with dogs and swine. This may be du in this experiment to a greater dilution of the ammonium salts incide on a large consumption of water by this class of animals. Data are als given on calcium and phosphorus metabolism during both neutral an acid periods of low nitrogen intake, as well as on a period of high nitroge intake. It is very probable that the skeleton was not drawn upon f calcium during the period of lowest acid ingestion. Only on a high ac ingestion did it appear probable that decalcification of the bones bega and then only a withdrawal of calcium carbonate.

The records of growth and reproduction give evidence that the natur acid rations, if otherwise satisfactory, are as effective for growth or repr duction as those of basic character. However, until it has been shown co clusively that less vigorous individuals will tolerate acid rations with pe fect impunity, conclusions of a too general character are unwarranted.

FEEDS AND FEEDING

299 – **Prickly Pear Feeding Experiments.** — HORN, E. W., *Department of Agricultu Bombay, Bulletin* 58 *of* 1913. Bombay, 1914.

In order to determine the possibility of using prickly pear (*Opunti* as fodder during times of famine, some feeding experiments were carri out at the Government Civil Dairy, Kirdee. Six bullocks were fed with mixture of 100 parts of prickly pear to 6 parts of cotton seed at the rate 72 lbs. per 1000 lbs. live weight per day for six months. The prick pear was prepared for consumption by first burning off the spines over stove and then cutting the slabs into small pieces by means of a cha cutter or a chopper ; the burning was accomplished at various rates, fro 30 to 100 lbs. per hour, according to the stove used. The composition the prickly pear fodder was as follows :

	Dry season	Wet season
	per cent.	
Moisture	79.32	92.75
Ether extract	0.78	0.22
Albuminoids	0.68	0.31
Carbohydrates	11.61	4.37
Fibre	2.48	0.85
Ash	5.13	1.60

The animals were in very poor condition at the beginning of the trial and all improved markedly as time went on ; four out of the six took the ration readily from the first while the other two were longer in getting accustomed to it. The fodder was also fed successfully to a mixed dairy herd of cows and buffaloes in quantities up to 14 lbs. per head per day, and to young stock. Altogether, as a result of the trials, it may be said that the mixture of prickly pear and cotton seed used will not only support life but enable an animal to regain condition even after it has become very poor from semi-starvation.

300 – **The Nutritive Value of New and Old Maize.** — NITZESCO, J. J., (Work of the Institute of Physiology at Bucharest) in *Comptes Rendus hebdomadaires des séances de la société de Biologie*, Vol. LXXVII, No. 33, pp. 583-586. Paris, January 8, 1915.

The aim of the writer's researches was to determine the nutritive vaiue of the last maize harvest and that of older crops. Experiments were carrried out on fowls and white mice, and the amount of starch, total nitrogen, uric acid (in the case of the fowls) or urea (in the case of the mice) present in the excrement was estimated. The experiments on the hens lasted 39 days and those on the cocks and mice for 41 and 32 days respectively. The results showed that new maize is less capable of being digested and assimilated than maize some seasons old and that mice suffer more than fowls from a prolonged and exclusive maize diet. The following are some of the results which refer to 1000 gms. of live weight.

	Hens	Cocks	Mice
Amount of maize assimilated.			
new . . . . . gms.	1 433	2 146	2 645
old . . . . . »	1 696	1 917	2 995
Coefficient of digestibility.			
of new maize . . . . . per cent	92	89.6	92.3
» old » . . . . . »	96	95.2	95.4
Increase (+) or decrease (—) in weight at the end of the experiment.			
with new maize . . . . . gms.	+ 427	+ 356	— 35
» old » . . . . . »	+ 632	+ 679	— 2

301 – **The Composition and Effects of Lupin Seeds.** — MUENK, GUSTAV, in *Die Landwirtschaftlichen Versuchsstationen*, Vol. 85, No. 6, pp. 893-416. Berlin, November 26, 1914.

The seeds of the blue, yellow and white lupins are rich in ferments. In addition to a diastasic enzyme and to others which respectively split up glucosides and peptones and produce changes in urea, there is a ferment, hitherto overlooked, that forms lactic acid from amylum and many kinds of sugar and should be of technical and toxicological importance. Possibly it might be used in the preparation of alcoholic beverages. There also exists in the seeds of the blue lupin a non-poisonous agglutinising enzyme, viz. a " phasin " as defined by Wiehus and Kobert. On heating this enzyme to 70-75° C., it is rapidly destroyed; the enzyme ricin, on the other hand, is not affected by this temperature and this distinction between

the two ferments serves as a useful test for detecting an admixture of casto oil seeds with blue lupin seeds. Further investigations are necessary t determine what kind of substance takes the place of phasin in the whit and yellow lupins.

302 – **The Effect of Palm Oil Cakes Upon Milk Production in Cows.** — HANSEN, J. (Mitteilungen vom Landwirtschaftl. Institut der Universität Konigsberg i. Pr., unte Mitwirkung von E. REISCH, F. EWALD, und F. LILIENTHAL) in *Landwirtschaftlich Jahrbücher*, Vol. XLVIII, Part I, pp. 1-70. Berlin, 1914.

The writer concludes from a critical review of the experiments mad by other workers and from the results of his own experiments that palm-oi cake does not affect the milk yield, but increases its fat content. He consi ders that this specific action increases with the increase of the amount of th cake contained in the ration and with the quantity of fat in the palm oi cake itself. In order to obtain a perceptible specific effect at least 2.5 t 3 lbs. per 1000 lbs. of live-weight should be used, if the cake is somewha deficient in fats (*i. e.* containing under 6 per cent of fat) or 2 lbs. per 1000 lbs of live weight if it is rich in fats (*i. e.* containing about 12 per cent of fat)

The effect of the palm oil cake varies with the individual cows, bu is in every case perceptible when the cake is fed in sufficient quantities Neither the milk yield nor the period of lactation when the palm oil cak is introduced into the rations seems to have any influence upon it action.

The writer considers an increase of 0 to 0.14 per cent in the fat conten of the milk to be but small ; 0.14 to 0.20 per cent as average ; above 0.2 per cent as large. Of the 21 cows which were the subjects of his exper iment, 5 showed a small increase in the fat content of their milk, 10 an aver age and 6 a large one, the maximum being 0.51 per cent.

303 – **Fish Meal as a Cattle Food.** — I. WOOD, R. CECIL, Use of fish as cattle food *Agricultural Journal of India*, Vol. IX, No. 4, pp. 356-361. Calcutta, October, 1914. – II. Utilization of cereal offals and other products for cattle feeding : 9. Fish meal *Journal of the Board of Agriculture*, Vol. XXI, No. 7, p. 608. London, October 1914.

At the Institute of Agriculture in Coimbatore, of which the writer i the Principal, experiments have been made in feeding cattle with fish pre viously salted and dried and then ground into meal. Ten young heifer were selected for the experiment ranging in age from 20 to 30 months 5 of them were kept on the fish diet and 5 on ordinary diet. The initi weight for the first group averaged 412 lbs. and for the second 402 lbs. Th animals were, at the time of the experiment on the following diet, so f as their concentrated food was concerned : cotton seed ½ lb., ground nu cake ½ lb., dholl husk (*Cajanus indicus*) ½ lb. Analysis showed this contain 0.329 lb. albuminoids, 0.483 lb. carbohydrate and 0.122 lb. fat.

Disregarding the digestibility of the various substances the albumi noid ratio works out to 1 : 2.3. In order to deviate as little as possib from this, the following ration was adopted: rice bran 14 oz., dholl hu ½ lb., fish meal ¾ lb. containing albuminoids 0.310 lb., carbohydrat 0.517 lb., and fat 0.102 lb., with an albuminoid ratio of 1 : 2.4.

A previous sample of dried fish contained 32.19 per cent. of soluble mineral matter, 3.21 per cent, of oils and extractives, 40.75 per cent of crude proteids. The sample used in the experiment was nearly the same but probably contained slightly more salt.

The experiment was begun on September 5 and continued to the middle of March. For the first six weeks the animals did not take kindly to the new diet, but thereafter seemed to find nothing distasteful in it. No ill effects were noticed but the fish fed animals gained less in live weight than the controls, the former gaining in the 6 months only 54 lbs. per head against an average of 70 lbs. per head in the case of the latter. There is some evidence that the fish diet incites earlier rutting as three of the fish fed group of heifers came into season and took the bull against one only in the control group. The cost of the fish diet was found to be a little less than that of the ordinary diet but against this advantage must be set the comparative loss in live weight.

In conclusion there is not much to be said for or against the plan except that it provides a useful way of disposing of otherwise useless fish.

II. — The richness of fish meal in readily digestible protein (50 per cent or more) renders it specially suitable for combination with other foods, relatively poor in this ingredient (such as roots, hay, straw, and the starchy cereal grains and offals). If fed in too large quantities or if it contains too high a percentage of oil both meat and milk are liable to be tainted. The proportion of salt should not exceed 3 per cent as an excess may cause illness especially in pigs. The following rations are suggested:

Cattle : 2 lb. for every 1000 lb. live weight.
Pigs : $^1/_4$ to $^1/_2$ lb. according to weight.
Sheep : $^1/_{10}$ to $^1/_5$ lb. for every 100 lb. live weight.

For poultry feeding, fish meal with a low percentage of oil and salt should be selected and the birds should be gradually accustomed to the food. Adults fowls should receive not more than 10 per cent and chickens not more than 5 per cent of their whole diet in this food.

304 – **The Value of Fish and Meat Meals for Fattening Pigs.** — MARTINOLI, G., in *Revista del Centro de Estudiantes de Agronomia y Veterinaria*, Year 7, No. 72, pp. 258-270. Buenos Aires, September 1914.

The aim of this experimental work was to determine, the comparative value of a vegetable diet and fish meal fed to pigs, and, in a second experiment, the comparative value of fish meal and meat meal in a mixed diet.

In the experiments made by the writer at the Zootechnical Institute of Buenos Aires a fish meal called " Schweinegold " was used. This is prepared from recently caught mullets and made under the supervision of the Municipality. It is a food which is very rich in albuminoids and phosphates, but poor in fats. The meat meal was supplied by the Liebig company. In comparison with fish meal, meat meal is richer in albuminoids and fats and much poorer in ash and dry matter.

The pigs were divided into two lots, their condition was as far as po sible the same, and the animals were sufficiently numerous to elimina the effect of individuality. They were fed *ad libitum* on rations of equivale nutritive value, the one exclusively vegetable, the other composed of grai and fish meal. The comparative value of these rations having been asce tained, meat meal was substituted for part of the exclusively vegetable r tion in order to determine in its turn, the feeding value of the meal. Th subjects of the two experiments were 10 young cross-bred middle whi pigs, the offspring of a pure Yorkshire boar and two cross bred sows of th same breed. Of the five pigs in the second group, one was removed owi to illness. During the second experiment, the four pigs of the secon group showed signs of insufficient development of the skeleton, owi to the fact that meat meal is deficient in mineral salts as compare with fish meal, so 80 gms. of precipitated bicalcic phosphate were adde to the rations of the four animals.

The writer gives a detailed account of the rations fed, the time the were given, their composition, the weight of the animals, their increase i live weight, etc. He further sets forth the conclusions to be deduced fro his observations, compares the economic results obtained and finally sum up his conclusions as follows:

1) In fattening pigs from the earliest age, fish meal proved an exce lent concentrated food, for, in addition to stimulating the appetite and th processes of assimilation, it permits good development of the skeleton the latter did not grow large, but was very thick and strong and showed marked contrast to that of other pigs fed on ordinary forage and meat mea In the latter case the fattening began when the skeleton was still in proce of development and the bones were too weak to support the weight of th body, so that the pigs moved little and with difficulty.

2) The animals fed on fish meal grew much more than the other their flesh and fat were of superior quality, fetchings ½ *d* more per lb. live weight. It was not observed that the fish or meat meal had imparte any particular smell or taste, either to the flesh or to the fat.

3) The economic results were also very favourable to feeding c fish meal.

4) It will be interesting to make other experiments in order to stud the action of fish and meat meals in more economical rations and under mo ordinary rearing and feeding conditions.

305 - **A Contribution to the Physico-Chemical Study of the Alcohol Solub Proteins Present in Wheat** (1) **and Rye.** — GÉOH, JULIUS, and FRIEDL, GUSTA (aus der kgl. ungar. tierphysiologischen Versuchsstation, Budapest) in *Biochemis Zeitschrift*, Vol. 66, Parts 1-3, pp. 154-164. Berlin 1914.

The writers aimed at determining, by means of physico-chemic analyses and colloidal investigations, whether the proteins present in whe and rye which are soluble in alcohol are a mixture or a simple substan They came to the following conclusions:

(1) See also *B.* Dec. 1914, No. 1098. *Ed.*

1) The gluten of wheat contains a single protein soluble in alcohol, *viz.* gliadin.

2) The gliadin is always the same, whether the gluten from which it is extracted is good, or bad.

3) The protein which can be extracted from rye flour is a mixture of several albuminoids of which the isolation presents enormous difficulty.

4) No substance identical with the gliadin of wheat was isolated from the rye protein.

306 – **Coat Colour in Horses** (1). — ANDERSON, W. S., Kentucky Agricultural Experiment Station, Lexington, Ky.) in *The Journal of Heredity*, Vol. V, No. 11, pp. 482-488. Washington, D. C., November, 1914. BREEDING

Hurst, Wilson, Harper, Sturtevant, Anderson and others have published papers on the inheritance of coat colour in horses. The writer gives a summary of all the available figures on the subject, collected from the various stud books. He has found that the American Saddle Horse Register, which has been compiled within the last thirty years and revised within a decade, contains about 2 per cent of errors concerning colour and he considers that there is no reason to believe that other registers are more accurate than the Saddle Horse Register.

The stud books regognize the following colours in horses: gray, roan, dun, bay, brown, black and chestnut.

In going through the American Saddle Horse Register the writer secured the colour in 5 591 matings, which involve the colour of 16 773 horses. To these numbers he adds, from Sturtevants tables, data on 8 464 matings, giving data on a total of 42 165 horses, from which he draws up a table, summarised below. The percentages are given in round numbers.

Matings	Foals			
	Chestnut	Black	Brown	Bay
Chestnut × Chestnut	14 115	10	1	5
Chestnut × Black	111	83	20	124
Chestnut × Brown	60	32	31	130
Chestnut × Bay	597	56	49	764
Black × Black	11	295	15	5
Black × Brown	14	198	219	115
Black × Bay	123	295	261	634
Brown × Brown	13	64	334	157
Brown × Bay	177	132	817	1449
Bay × Bay	474	107	300	2831

	Chestnut	Black	Brown	Bay	Gray	Roan
Roan × Chestnut	9	3	2	9	1	14
Roan × Black	1	11	3	1	0	15
Roan × Brown	1	5	16	18	1	28
Roan × Bay	9	5	13	39	1	50
Roan × Gray	0	0	3	0	5	7
Roan × Roan	0	0	0	3	2	

(1) See also: *B.* Jan. 1914, No. 44; *B.* Feb. 1914, No. 151; *B.* April 1914, No. 355. (*Ed.*).

	Gray	Not-gray
Gray × Not-gray	439	528
Gray × Gray	47	18

Of the Chestnut × Chestnut matings 12 497 belong to the Suffolk breed and they all gave chestnut foals. The breed traces back to the year 1769.

The writer has been contending for the last three years that chestnut is a true recessive. He has not succeeded in hearing of any case of a foal that was black, gray or bay from parents both of which were chestnut. In the Saddle Horse Register some foals were reported as not-chestnut from chestnut matings, but in every case the writer was able to find that a mistake had been made in the record. He consequently believes that the 16 cases recorded (see Table) are due to mistakes in registration.

In order to prove the recessive nature of chestnut the fact is not sufficient that chestnut matings produce only chestnut foals, as any colour can behave that way in reproducing itself if it be pure bred. The chestnut matings which have been tabulated represent individuals with all colours in their ancestry. There would be a tendency to transmit these various colours if chestnut were not recessive.

Another conclusive proof of its recessive nature is the production of chestnut from other colours. The above tables show that in :

Black × black	matings	there	are	3	per cent	chestnut	foals
Black × brown	»	»	»	3	»	»	»
Black × bay	»	»	»	10	»	»	»
Brown × brown	»	»	»	2	»	»	»
Brown × bay	»	»	»	7	»	»	»
Bay × bay	»	»	»	13	»	»	»

Here are six classes of matings with no external evidence of chestnut in the animals mated, nevertheless there came from them chestnut foals, just as one would expect if chestnut were recessive. Besides which the chestnut horses when thus produced breed true for chestnut as expected.

The writer has observed that black × chestnut matings give 33 per cent chestnut, 24 black, 6 brown and 37 bay. The explanation of these two latter percentages is somewhat difficult. Both black and chestnut are recessive to bay and there should be no bay foals from this class of matings. There is evidently some relationship between the factors which produce chestnut and black and the factors which produce bay, but the writer is unable to say what this relationship is.

There are some stallions that are homozygotic for their own colours and are unable to produce even from chestnut mares any chestnut foals.

Black is dominant to chestnut and hypostatic to brown, bay, gray, and roan. The percentage of black colts from the cross of black and brown and black and bay are 36 and 22 respectively, *i. e.* approximately the figures that the Mendelian law would require.

In view of all the evidence the series seems to be: chestnut recessive to all, black dominant to chestnut and recessive to all others, bay dominant to chestnut and black and recessive to the three coordinate colours, gray, roan and dun.

The colours can be arranged in three series:

Gray	Roan	Dun
Bay	Bay	Bay
Black	Black	Black
Chestnut	Chestnut	Chestnut

The writer's records show 3712 bay matings, and there is not a single gray, roan or dun horse thus produced.

The evidence of the dominant nature of bay to black and chestnut is that out of 3712 bay matings 76 per cent are bay, 3 per cent black, 13 chestnut and 8 the so-called brown.

That gray and roan are dominant to bay there can be no doubt; 967 foals from matings gray × not-gray produced 46 per cent gray and 54 per cent not-gray. It is known that homozygous gray when mated with any of the four popular colours will always produce a gray. It is only from a heterozygous gray that other than a gray can be produced.

The factor for the roan pattern seems to be independent of the factor for colour and by mingling white hairs with the three colours chestnut, black and bay produces the three varieties of roan horses *i. e.* chestnut, blue and strawberry roans. The determiner for roan is present or not present in the germ plasm. Its presence is dominant over its absence. It in no way interferes with the inheritance of the colours among themselves. When once in the germ plasm of a strain of horses its persistence is remarkable. But when it disappears like the gray it will not reappear unless introduced afresh.

So alike is the behaviour of gray and roan that the evidence points to a unity of the two. The gray horse is, perhaps, one form of the black roan. The difference between the gray and the black roan is only one of pattern and the quantity of white hairs, which are more plentiful in the gray than in the roan.

307 – **Some Data Respecting the Artificial Fertilisation of Mares.** — Von Nemeshegyi, Oskar, in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 32, pp. 383-384 + 1 Plate. Hanover, 1914. HORSES

The artificial fertilisation of mares, although for a long time the object of research, has only lately attained practical importance through the work of Dr. Ivanhoff, the Chief of the physiological department of the Veterinary Service in Petrograd. This investigator fertilised no less than 579 mares with natural spermatozoa, between 1899-1910, and obtained excellent results. Most of the offspring of these mares have proved useful animals; the results from a stud of Russian trotters have even been successful on the race-course, and remounts and draught animals have also done well.

Ivanhoff's method has the advantage of not injuring the reproductive organs and is easy to carry out. It has also been adopted with much

success at the Hungarian State Stud, Kisbér by Dr. Treisz. The latter however used somewhat differently constructed instruments in his experiments and only disinfected them in boiling water. Further, the spermatic fluid was not diluted with milk, but injected pure directly into the uterus, 5 cc. being used at a time, while Ivanhoff prescribed 10 cc. The results obtained at Kisbér showed that 5 cc. should be amply sufficient to fertilise one animal.

So far, the experiments in Hungary have been carried out on 5 half-blood mares, which Treisz fertilised with the spermatic fluid of an English imported thorough-bred. The mares which were always kept separate from the stallion, gave birth a short time ago to 5 completely healthy foals. As the experiments have proved so successful in Hungary, they will be continued.

CATTLE

308 – **The Value of Castration of Deccan Bullocks.** — KNIGHT, J. B., (Professor of Agriculture, Poona) in *Department of Agriculture, Bombay, Bulletin* No. 62, pp. 1-6, + 2 Plates. Bombay, 1914.

Castration of bullocks is practised over most of India and especially in Gujarat. The greater docility of the cattle which is thus obtained is apparent in the straightness of the rows of cotton and other crops in that province.

Considerable variation exists as to the most suitable time to effect this operation and since late castration tends to interfere with the live stock breeding scheme of the Department of Agriculture it was decided to carry out experiments to determine the comparative value of early or late castration on the subsequent growth of the cattle.

The experiment was begun in 1904 with 22 bull calves of the Deccan breed. For various reasons only 16 of these yielded complete data. Half of these were castrated when about 8 months old and the other half on reaching maturity.

The results of the two lots are as follows:

I. — *Increase in weight.*

Lot	Average weights in lbs.		Average increase in weight in lbs.
	1904	1907	
Early castration	222.5	504.5	282
Late castration	226.5	511.75	285.5

Thus, the time of castration appears to have little effect on the total weight of the animals, but the slight difference (3 ½ lbs.) is in favour of late castration.

II. — *Increase in girth.*

Lot	Average girth		Average increase in girth
	1904	1907	
	ft. in.	ft. in.	ft. in.
Early castration	3 9	5 8.5	1 11.5
Late castration	3 9.2	5 8.1	1 10.9

III. — *Increase in height.*

Lot	Average height.		Average increase in height
	1904	1907	
	ft. in.	ft. in.	ft. in.
Early castration	3 0.2	3 6.6	6.4
Late castration	3 0.6	3 6.2	5.6

These results show a very slight increase in girth and height in favour of early castration.

An attempt was then made to ascertain if there was any difference in the development of the muscles of the fore and hind quarters of the two lots of bullocks.

The following measurements were taken :

a) Neck measurement as near the shoulder as possible.
b) Under the neck and over the shoulders back of the hump.
c) From hip bone under tail round to other side.

Lot	Average measurements		
	a	*b*	*c*
	ft. in.	ft. in.	ft. in.
Early castration	4 2	5 4.1	4 3.7
Late castration	4 2.6	5 9.9	4 3.2

The first of these measurements shows only about half inch in favour of late castration, but the second measurement which covers the large muscles running to the hump and neck shows a gain of 5.8 inches in favour of late castration. Comparing the third measurement with the second, that is, the development of the quarters to that of the shoulders the ratio in the case of early castration is 1 : 1.24 and in the case of late castration

1 : 1.34, thus showing the greater proportionate development of the hind quarters due to early castration. When these animals were worked on the farm it was noticeable that the early castrated ones were sharper and more docile and capable of a larger maximum draught than the late castrated ones. Also they certainly did not show any signs of being less hardy.

309 – **Report on the Calf-Rearing Experiment Conducted at the Woburn Experimental Farm, 1913-1914.** — VOELCKER, J. A., *Publication of the Royal Agricultural Society of England*, pp. 7. London, April 1914.

Twenty four calves were fed with whole milk to an age of 4 to 5 weeks, and then divided up into 6 lots which were gradually brought on to the following diets :

Lot 1 Cod liver oil and separated milk.
» 2 Calf meal "A".
» 3 Gruel (linseed and oatmeal) with separated milk.
» 4 Whole milk.
» 5 Crushed oats and separated milk.
» 6 Calf Meal "B".

The experiment was continued for 12 weeks and the results obtained were as follows :

Food	Cost per calf per week		Gain per calf per week	Cost per lb. gain in live-weight
	s	*d*	lbs.	*d*
Lot 1 Cod liver oil	2	0.67	6.54	3.77
» 2 Calf meal "A"	1	6.77	6.58	2.85
» 3 Gruel	2	0.89	5.71	4.35
» 4 Whole milk	5	3.93	8.29	7.71
» 5 Crushed oats	2	0.19	8.29	2.92
» 6 Calf meal "B"	1	7.44	6.20	3.13

From these results it will be seen that much the highest gain was obtained with whole milk and with crushed oats. The former food was by far the most expensive, while the crushed oats were practically as low as any other food; the best return altogether was therefore obtained from the crushed oats, a result precisely the same as that obtained in a former experiment.

POULTRY

310 – **A Study in Annual Egg Production.** — BALL, E. D., TURPIN, G., and ALDER, B., *Utah Agricultural Experiment Station, Bulletin*, No. 135, pp 44. Logan, Utah, 1914.

Careful records of egg production were made for seven years with flocks of White Leghorn hens. Not only was the original flock kept during the whole period in order to determine the falling off in productiveness

with increasing age, but fresh flocks derived from the original stock were added each year. The average annual production for all flocks was :

124 eggs for the 1st year
124 » » 2nd »
112 » » 3rd »

The average falling off in production in the third year was small and there was evidence that strains could be isolated in which it would be still smaller so that such birds could be profitably kept an extra season in order to avoid part of the expense and trouble of renewing half the stock each year as is usual in poultry farming. The results also shewed that a pullet's performance during the first season is not a reliable means of judging of its productive capacity during the second and subsequent seasons.

311 – **The Encouragement of Bee-Keeping in Prussia.** — Decree of the Prussian Minister of Agriculture in *Ministerialblatt der Königlich Preussischen Verwaltung für Landwirtschaft, Domänen und Forster*, Year 10, No. 8, pp. 225-226. Berlin 1914. BEES

The last census of beehives in Prussia in 1912, gave a return of 1 509 586 as against 1 541 350 in 1907, a decrease of about 32 000 or of 2 ½ per cent. During the same period, the number of beehives in the Empire had increased from 2 594 690 to 2 630 837. This unsatisfactory return for Prussia added to frequent complaints made by apicultural societies and by special journals on the difficulties in which bee keepers find themselves, have incited the Minister of Agriculture to take more efficient measures for the encouragement of apiculture.

The unfavourable state of things is due to several causes of which, without mentioning the adverse meteorological conditions of recent years, the following may be noticed as the most important.

1) The bringing under cultivation of lands hitherto untilled and neglected, the result of which is a reduction of the areas from which bees can find honey.

2) A more intense system of cultivation which means the disappearance of weeds and their flowers.

3) The reduced number of white clover fields due to the decline of sheep rearing.

As remedies the Minister of Agriculture issues the following recommendations :

1) To promote, along the edges of fields and pasture land, as well as on the sides of paths and of watercourses the growth of plants likely to provide what the bees require during certain seasons, thus making it possible for them to store honey in the combs.

2) To raise the level of instruction for apiculturists and above all to extend the practice of beekeeping among practical cultivators.

The Minister's ordinance also indicates the possibility of the State providing more considerable grants for the establishment of model plantations designed to provide a satisfactory gathering ground for the bees as well as for a greater expansion of courses of instruction in apiculture.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

312 – **Trial of a Patent Rapid Steamer for Cattle-Food.** — FISCHER, GUSTAV, in *Mitteilungen des verbandes tandwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 8, Part. 4, pp. 163-166. Berlin 1914.

This paper is the fourty fourth Report of the Machine Testing Office of the Chamber of Agriculture for the Province of Brandenburg, Germany. The machine that was tested bears the name "Original Jaehne.". It differs from older machines of the same kind in being provided with a screw which removes the steamed food and forces it into a crusher.

It consists of a sheet iron box in which the food and the water are placed; this rests on a support which contains the fire-box and stands on four angle iron legs.

Along the sides of the sheet iron box, angle irons are bolted and on these a perforated false bottom and a tray rest. On heating, the steam passes through the holes in the sides of the tray and the perforations in the false bottom to the fodder in the box.

The condensation water together with the dirt washed out from the food falls into the tray and thence without ever coming into contact with the heated fire box, through a funnel, into a cast iron collector, from which they can be easily removed through suitable openings.

When the food is steamed the steamer is emptied by turning a screw which passes through the box, by means of a crank handle. The food is thus forced to a crusher fixed to the outside of the sheet iron box, where it is broken up and then falls into a vessel placed below.

In steaming potatoes, stones sometimes jam in the grating at the crusher, in which case a special device worked by the handle allows them to be easily removed.

The machine is built in eight sizes for quantities of potatoes varying from 143 to 880 lbs. and costing from £ 6 2*s* 6*d*. to £ 18 17*s* 4*d*.

The machine that was tested was of a size that was filled by 373 lbs. of potatoes; it consumed 19. 8 lbs. of lignite. The whole operation of steaming lasted 69 minutes.

In the opinion of the judges the machine meets satisfactorily the needs of practical farmers; its management is simple and easy, and its design and construction promise durability; especially noticeable is the ingenious device of the crusher, the work of which is but slightly affected by the presence of stones or other foreign bodies.

313 – **Review of Patents.**

Tillage Machines and Implements.

Canada	157 613	Ploughing machine.
	157 704	Plough.
	157 763	Ditching plough.
	157 955	Ditching machine.
	158 008	Ditch digger.

Cuba	2 173	Double ridging plough.
France	473 002	Folding harrow.
Germany	279 330	Rake made from a single strip of sheet iron.
	280 150	Screw for propelling agricultural machines, tilling the soil and utilizing part of the weight of the machine.
	280 338	Frame for motor roller, with platform that can be weighted, for the cultivation of moors.
	280 467	Motor plough with triangular frame carrying at the rear an adjustable arm with supporting and steering wheel.
	280 659	Harrow with rotating blades and adjustable axles.
Italy	144 085	Hoeing machine for vineyards.
	144 082	Special sliding furrow-opener for growing rice on ridges.
	145 020	Directly hauled apparatus for machine ploughing, especially suitable for vineyards and citrus fruit groves.
	142 766	Improvement in machine hauled ploughs.
	142 089	Motor plough.
Spain	59 179	Improvement in turn-wrest ploughs.
Switzerland	68 010	Plough with device for drawing a slit in the slice turned over.
	68 123	Hand rake.
United Kingdom	19 243	Machine for thinning turnip crops etc.
	19 326	Clips for attaching coulters, wheel slides, hoes etc. to ploughs.
United States	1 118 511 — 1 118 882	Cultivators.
	1 118 089	Ridging device.
	1 118 566 — 1 119 199 — 1 119 998 — 1 120 603 — 1 120 856 — 1 122 033	Ploughs.
	1 118 084	Adjustable plough-hitch.
	1 119 143 — 1 121 320 — 1 121 468	Harrows.
	1 119 226	Draft attachment for ploughs.
	1 119 423 — 1 119 624	Gang plough.
	1 119 562	Cotton chopper.
	1 120 371	Weeder.
	1 119 862	Disk plough.
	1 120 158	Disk harrow.
	1 120 875	Clod pulverizers.
	1 121 427	Plough harrow.
	1 121 711	Cultivator shovel.
	1 121 844	Power operated plough.

Manure distributors.

Canada	157 663 — 158 614	Manure spreaders.
Germany	280 151	Fertilizer spreader with compartments on one of the distributing slides.
	280 406	Feeding device for the vertical toothed distributing disks in fertilizer spreaders and the like.
United States	1 120 021	Fertilizer distributor.

Drills and sowing machines.

Canada	157 627	Seeder.
	157 729	Seeder and fertilizer.
	157 893	Grain drill mechanism.
Germany	280 200 — 280 889 — 280 468	Potato planters.
	280 469	Covering and pressing device for drills.

Germany	280 530 Potato planter with adjustable wheel provided with compartments.
	280 570 Potato planter with fixed hopper and rotating distributing wheel.
Spain	59 112 Sowing machine that can be applied to any kind of plough.
United States	1 118 932 — 1 119 152 — 1 120 912 Corn planter.
	1 119 675 Corn planter attachment.
	1 118 918 Grain drill.
	1 120 598 Hand planter.

Reapers, Mowers, etc.

Canada	157 629 Shocking machine.
	157 905 Flax puller.
	158 175 Conveyor for binding machine.
	158 353 Truck for binding machine.
	158 439 — 158 512 Sheaf loaders.
Germany	280 339 Lifter for lodger grain, for reapers.
Switzerland	68 124 Knife arrangement for mowers.
United States	1 118 398 Binder reel attachment.
	1 118 901 Folding hay rake.
	1 118 636 Sugarcane stripper and topper.
	1 119 072 — 1 121 895 Corn harvester.
	1 119 048 Bundle carrier crane.
	1 119 475 Windrowing and bunching machine.
	1 119 898 Header attachment for binder equipped harvesters.
	1 119 795 — 1 121 592 — 1 112 172 Cotton picking machines.
	1 121 375 Swath cleaner and divider for mowing machines.
	1 120 977 Harvester for peas, beans or the like.
	1 121 389 Hay sweep.
	1 121 998 Ensilage harvester.
	1 122 140 Mower.
	1 121 814 Reaper thresher.
	1 121 984 Mowing apparatus.
	1 121 974 — 1 121 592 — 1 122 172 Cotton croppers.

Machines for lifting root crops.

Denmark	19 647 Potato lifting machine.
Germany	280 290 Side delivery oscillating screen for potato lifting machines.
United States	1 119 138 — 1 121 372 Beet harvesters.
	1 121 839 Beet topping device.

Threshing and winnowing machines.

Canada	157 678 Beater tooth.
	157 781 Cylinder for threshers.
	157 438 Grain separator.
	157 609 Threshing machine.
Germany	280 440 Device for lifting the short straw from threshing machines onto the table of the straw press.
	280 571 — 280 572 Threshing machines.
Italy	144 814 Maize sheller.
Spain	59 189 Improvement in riddles for winnowers and the like.
United States	1 118 191 Cavings-thresher for reaper thresher.
	1 121 398 Twine saving attachment for threshing machines.
	1 121 937 Corn husking machine.

Machines and implements for the preparation and storage of grain and fodder.

Canada	157 623	Grain grinder.
	157 694	Grain cleaner and grader.
Denmark	19 563	Straw press.
	19 698	Turnip cutting machine.
United States	1 118 946 — 1 119 037	Hay presses.
	1 120 346	Automatic hay baler.
	1 120 402 — 1 121 449	Baling presses.
	1 121 684	Ensilage cutter.
	1 121 821	Hay loader and stacker.

Dairying machines and implements.

Germany	280 380	Milk separator with vertical curved partitions in drum and with milk feed at various heights.
United States	1 119 214	Milking machine.
	1 120 469	Cream separator.
Denmark	19 690	Rotating cheese shelf.

Other agricultural machines and implements.

Canada	158 079	Steering device for traction engine.
	158 136	Calf weaner.
	158 198	Grain pickling machine.
	158 232	Shears for hedges.
	158 244	Draught equalizer.
	158 356	Saw for trees.
France	473 049	Pump for sulphuric acid sprayer for the destruction of weeds.
	473 343	Process and apparatus for treating carobs.
Germany	280 439	Machine for freeing fruits from their outer pulp, especially oil palm nuts.
Spain	58 836	Universal press for wine, oil and the like.
Switzerland	68 042	Flour and groat mill.
United Kingdom	19 169	Momentum apparatus for raising liquids.
	19 188	Machine for removing the pericarp from palm-nuts etc.
	19 504	Reachers for picking fruit.
United States	1 117 966 — 1 120 326	Tractors.
	1 118 837	Tongue truck.
	1 118 341	Traction machine.
	1 118 091	Multiple-row plant-spraying machine.
	1 120 420	Disk sharpener.
	1 120 477	Farm tractor.
	1 121 323	Draught equalizer.
	1 120 692	Traction engine.
	1 121 869	Device for extracting traction wheels from holes.

314 – **Draining of the Zuyder Zee.** — *Le Génie Civil*, Vol. LXVI, No. 4, p. 58. Paris, January 23, 1915.

BUILDING CONSTRUCTION

The Zuyder Zee which occupies an area of about 9640 square miles in the centre of Holland has only a very slight depth, less than 16 feet over several hundreds of square miles. For the partial drainage of this area the first project was drawn up in 1866. Since then further surveys have been made and the final project, which was completed in 1894, has now

received the approval of the Dutch Government which intends to commence the work at an early date.

The project includes a principal dam which will close the mouth of the Zuyder Zee, and four secondary dams which will surround the parts of the gulf which will be reclaimed, while the rest of the Zuyder Zee will become a fresh water lake fed by the river Yssel.

The main dam will be 18 miles long with an average breadth of 328 ft. at its base. Its top will be 16 ft. 5 in. above high water mark, it will join the island of Wieringen to the mainland at Ewykslins on one side, and at Piaam on the other. The slope facing the sea will be protected by an auxiliary dam of large blocks of stone reaching up to the mean water mark. The rest of the dam will be of sand dredged from the Zuyder Zee and covered with a layer of clay. The slopes will be protected by rubble.

In the lake thus formed the secondary dams will be built to reclaim four large new polders, each of which will be divided into three or four minor ones at different levels and which will be successively drained to admit of the higher ones being cultivated without delay. Each will have its own pumping station, at the rate of 1 ½ HP per 1000 acres and per foot of difference of level. The total HP required will be 17 000.

The lake of Yssel into which the river Yssel and several canals will flow, will communicate with the sea by locks near the island of Wieringen. It will be kept at a constant level and will thus facilitate navigation.

It is estimated that the works will be completed in about 30 years. They will cost about £18 000 000. The revenue of the whole undertaking will be £5 600 000 while at present the fishing in the Zuyder Zee yields barely £160 000.

315 – **Dam Building at Seven Cents a Yard by Hydraulic-Fill Method.** — *Engineering Record*, Vol. 70, No. 2. pp. 46-47. New York, 1914.

The relative behaviour of sand and clay when conveyed and deposited by running water is the principle on which five dams have been constructed in California at a very low cost per cubic yard. According to this method centrifugal pumps lift the material from the reservoir site onto the dams and the flow is so controlled that the clay settles and is compacted on the centre line of the structure where it forms an impervious core. The coarser material, pumped in together with the clay, flanks this central deposit and thus there is built up a pressure compacted clay core wall supported on either side by coarse porous material.

As the dam is built up a shallow lake is maintained on its top by continually diking up the earth along the crest of both upstream and down stream slopes. The pumps that lift the material pour their discharges into this lake along its borders, and a vertical pipe which acts as an overflow, situated in the centre of the lake keeps down the water level to the height consistent with the best results. The discharge pipes are occasionally shifted in order to maintain an even distribution and the dikes and over-flow levels are adjusted from time to time so as to keep pace with the progress of the work.

The Fernando reservoir is about 25 miles from Los Angeles, Ca. On June 1, 1914 about 65 per cent of the dam was completed. It will be 145 ft. high, 1700 ft. long on the crest and will contain 2 000 000 cubic yards of material. Only 4 to 6 per cent of this material is moved in any other way than by water as a vehicle.

The qualities considered in selecting material for the dam are that it shall contain at least 20 per cent of clay and silt and that its general character be such as to allow a powerful jet of water to cut it down into shape suitable for the pumps.

The maximum distance which material has thus far been conveyed is about 3000 ft. Pumping has been continued up to heads as high as 80 ft., but as it was not found economical, a maximum of 50 ft. has been adopted.

In laying out the piping systems the pumps are situated where they can be fed, by natural open channels on a 3 per cent gradient, from the bank where the water jets ply. The jets used issue from 2 inch nozzles fed by 4 inch pipes under a pressure of 140 to 160 lbs. per square inch maintained by a centrifugal pump.

When the water was scarce none of it was wasted; it was pumped back again from the lake overflow to the bank where the work was in progress.

As taken up by the pump intake the normal solid content of the water is calulated to be 1 cu. yd. per 10 cu. yds. The pumps used have 12 inch intake and discharge and are operated at 600 revolutions per minute by 2200 volt motors. The pipes are 14 inch in diameter and each handles about 4000 cu. yd. of material per 24 hours run. These pipes cost 48 $^{3}/_{4}$ cents per foot and their life averages 500 000 cu. yd. of material handled. The current is purchased at 1 $^{1}/_{2}$ cents per kilowats hour, and the total cost of placing the material works out to 7 cents per cubic yard.

A crew of six men for each shift is sufficient to operate two pipe systems (that bring 8000 cu. yd. per 24 hours) except when diking up or moving plant.

The upstream slope is paved with rubble to about one half the total height and above this level a layer of concrete is to be placed as protection against wave action.

316 – **Automatic Dam Crests.** — I. Automatic dam crest with moveable counterweight. *Engineering Record*, Vol. 70, No. 22, p. 584. New York, Nov. 28, 1914. — II. Moveable crests for dams. *Ibid.* Vol. 69, No. 25, pp. 708-709. New York, June 20, 1914. — III. Nouveaux types de hausses mobiles, système Marshall pour barrages. *Le Genie Civil*, Vol. LXVI, No. 5, p. 80. Paris, January 30, 1915.

In the accompanying drawing, fig. 1 shows a type of automatic flash board for dams invented by W. N. Itte and J. Martin of Zürich, Switzerland. The water pressure on the flashboard which is hinged at its lower edge is balanced through the lever combination by a counterweight. This weight is placed in guides and can move within certain limits. When the water has reached the level shown, the pressure of the water and the counterweight balance each other. As soon as the water rises above this level the hydrostatic pressure increases and a corresponding lowering of the flash board takes place. This increases until the lower arms of the

lever gets into a position permitting the counterweight to roll in its guides when the flashboard suddenly takes the position indicated by the dotted lines. Because of this feature a considerable fall in water level must take

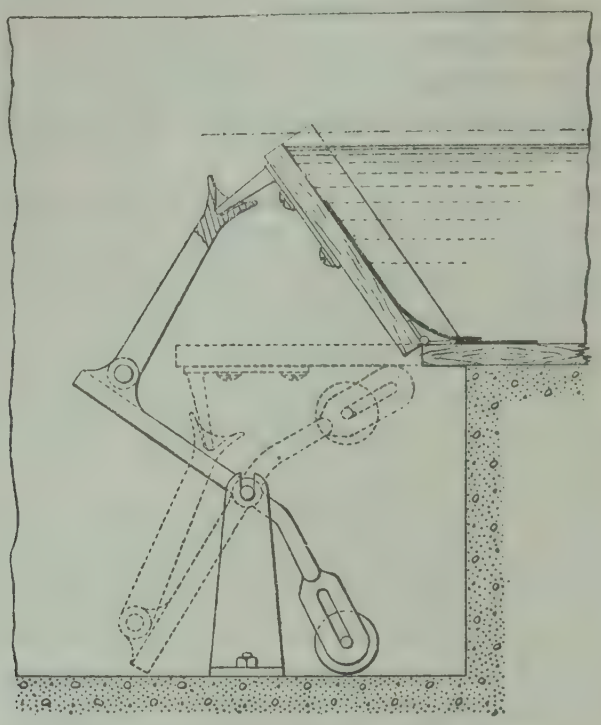


Fig. 1.

place before the moment of the hydrostatic pressure becomes less than that of the counterweight, and when this begins to move the increase in

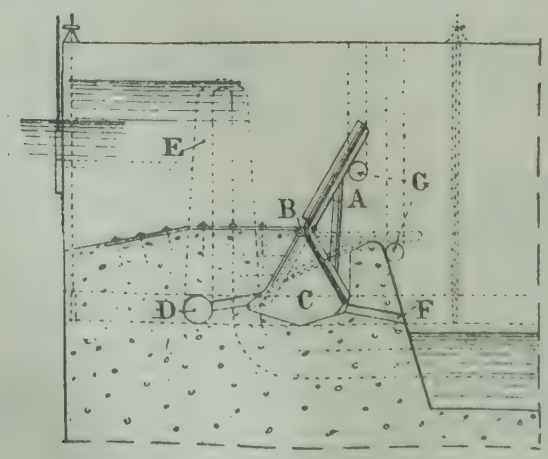


Fig. 2.

moment will be sudden and the flashboard will rise quickly. By adjusting the dowel by which the gate is supported on the lever, the water levels under which the flashboard rises and falls can be regulated.

Fig. 2. show a novel type of movable dam crest proposed by Gen. WILLIAM L. MARSHALL consulting engineer to the Secretary of the Interior, U. S.

It consists in a movable crest *A* constisting of two pieces forming an angle with each other and fixed by the vertex *B* to the sill of the weir. The water of the upper reach of the canal enters the chamber *C* by a feed pipe *D* connected with the lower reach by a siphon *E* which is completely filled when the highest water mark allowed is reached.

As long as the water level in the upper reach keeps below the maximum level the water fills the chamber *C* under pressure and forces the lower panel of the crest against the front wall so as to barely cover the drain *F*.

When the maximum level is attained the siphon *E* gets charged and begins to act; it empties the chamber *C*, and diminishes the pressure against the lower panel, while the pressure of the water against the upper panel prevails and the crest falls down on the front wall of the weir.

Care is taken so to arrange the chambers as to cause mud and sediment to be swept by the motion of the crest into or near the water supply and exit pipes or scuppers, and to allow sufficient leakage to keep mud from accumulating; further, air passages *G*, are provided to remove vacuums that form under the gate and tend to increase the pressure on the upstream faces of gates and dams.

This type with siphon control falling down stream admits of trussing or bracing, so that it is possible to make the crests very light and at the same time strong and stiff against warping, and of any reasonable length.

AGRICULTURAL INDUSTRIES

317 – **On the Deodorisation of Olive Oil.** — BARRION, GEORGE, in *Régence de Tunis, Protectorat français, Direction générale de la Colonisation, Bulletin*, Year XVIII, No. 80, pp. 573-578. Tunis, August-December 1914.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

In order to show the importance that the method which he proposes might have for Tunisian olive-growing, the writer begins by stating that at the present time there are 11 ½ million olive trees in Tunis while in 1913, the exports amounted to 11 113 tons of pure olive oil, valued at £ 678 660, and 2564 tons of olive-husk oil, valued at £ 71 790, the internal consumption being estimated at 18 000 tons per annum.

For the refining of lower grade oils the methods hitherto adopted have consisted either in washing with water, or in chemical treatment, or in filtration. None of these however, succeed in freeing the oil from its unpleasant flavour of rancidity. The writer therefore proposes that the deodoring methods employed for refining other oils should also be adopted in the case of olive oil. This consists in filtering the oil through animal charcoal in order to decolorise it, followed by the neutralisation of any acids which are present and treatment with steam at reduced pressure in a closed vessel. The rancidity products being more volatile than the oil, are

carried off by the current of steam ; there is thus left behind an oil which has no unpleasant smell, but is insipid and non-aromatic ; these defects are remedied by mixing it with unrefined oils.

DEPENDING ON ANIMAL PRODUCTS

318 – **The Present State of the Dairying Industry in Bombay.** — KNIGHT, J. B., and HORN, E. W., in *Department of Agriculture, Bombay, Bulletin* No. 56, pp. 1-14. Bombay, 1914.

Dairying from the Western standpoint can hardly be said to exist in the Presidency to-day, but the working up of dairy products by separating stations and creameries in Gujarát has assumed considerable proportions. The most extensive dairying is carried on in the districts of Kaira, Ahmedabad and parts of Baroda, where a large number of buffaloes are kept by the cultivators in herds of from 3 to 20; these herds produce milk for the separating stations that have been established within the last 20 years and now form a net work along the railway lines. The separating stations are owned by parties who buy the milk outright at current rates from the cultivators, separate it, and supply creameries in Bombay and elsewhere with cream and convert any excess into butter.

Two species of animals are used in India for dairying : the Indian cow (*Bos Indicus*) and the Indian buffalo (*Bos babulos*) ; four breeds of the former yielding an average of 2000 lbs. of milk annually and three breeds of the latter averaging 2500 lbs. These cannot be considered as satisfactory breeds for the purpose and present methods of management are opposed to any improvement.

Improvement is necessary and can only be obtained by scientific breeding and by the introduction of pedigree dairy strains for crossing purposes.

319 – **The Cost of Pasteurizing Milk and Cream.** — BOWEN, JOHN T., (Bureau of Animal Industry) U. S. Dep. of Agr., Washington, April 27, 1914.

Two systems of pasteurisation are in force known respectively as the " holder " and the " flash " processes. The first consists in " holding " the milk or cream for about 30 minutes after it has been heated to the pasteurising temperature of 140° to 150°F. either in the same apparatus in which the pasteurisation takes place or in separate holding tanks arranged for the purpose, after which it flows to the coolers. In the " flash " or continuous process the milk or cream flows from the receiving tank to the pasteurizer where it is heated to a temperature of from 160° to 165° F. in from 30 seconds to 1 minute and thence to the coolers.

The writer set himself to ascertain by experiments conducted under practicals condition, the difference of the net cost in the two processes. He obtains his conclusions from a study of the operation in the pasteurisation establishments of 5 towns representing average conditions. The results are these :

1. The flash process demands an expenditure of heat about 17 per cent greater than the holding process. It follows that the refrigeration has to be effected through a wider range in this case involving a greater cost.

2. The efficiency of the pasteurization plant depends much on the

proper design and arrangement of the boiler, regenerator, cooler, pipe system and refrigerating apparatus.

3. With an apparatus badly arranged and with a defective pipe system the loss of heat can amount to about 30 per cent of what is necessary for pasteurization while it ought to be reduced to a negligeable quantity.

4. It is possible to utilize the exhaust steam from the engine or the steam driven auxiliaries or water heated by the exhaust steam to furnish the heat required for pasteurization of both milk and cream.

5. In the milk plants and creameries an amount of heat is usually lost in the exhaust steam which would suffice for pasteurization.

6. For every 400 lbs. of milk pasteurized per hour with exhaust steam, approximately one horse power is taken off the boiler plant.

7. The average cost of pasteurizing 1 gallon of milk is shown to be $0.00313.

8. The average cost of pasteurizing 1 gallon of cream is shown to be $0.00634 or $0.0756 per 100 pounds.

9. It must to be undersood that the cost of pasteurizing as figured in this paper deals only with the pasteurizing cycle, *viz.* starting with the initial temperature of the raw milk and raising the temperature to the pasteurizing point, then cooling the milk down to the initial temperature of the raw milk. In other words it has been attempted to show the additional expense encountered in producing pasteurized milk and cream over the cost of the raw product.

The cost of coal is taken throughout at 4 dollars per ton with a heating value of 12 500 British thermal units per pound.

320 – **The Rate of Inactivation by Heat of Peroxidase in Milk. I.** — ZILVA, S. W., (Lister Institute) in *The Biochemical Journal*, Vol. VIII, No 6, pp. 656-669. Cambridge, December 1914.

The determination of the activity of peroxidase in milk has previously been suggested as a means of detecting whether milk has been subjected to heating ; in the present paper the temperature coefficient for the inactivation of peroxidase in milk and the influence of acidity and alkalinity and of neutral salts in the rate of inactivation were studied.

The temperature coefficient for the inactivation of peroxidase in milk by heat was found to be 2.23 per degree C., a value of about the same order as the temperature coefficients for the inactivation by heat of principles like tetanolysin and vibriolysin nasik and for the rate of coagulation of egg albumin. The rate of inactivation of peroxidase, however, was so small below 70° C. that it did not afford the opportunity of utilizing the peroxidase reaction as a test for pasteurisation; the reaction might nevertheless indicate whether pasteurised milk had been overheated.

Small additions of acid retarded and of alkali accelerated the rate of inactivation of peroxidase while the presence of salts retarded in a pronounced way the inactivation. This retardation varied with different salts and was independent of the valency of their ions.

The experiments were repeated using whey in the place of milk and it was found that in whey too the inactivation of peroxidase proceeded as a reaction of the first order, and that the presence of salts had a retarding influence on the rate of inactivation of the enzyme.

321 – **The Iron Content of Cow's Milk.** — NOTTBOHM, F. E., and DÖRR, G., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 28, Part 9, pp. 417-424. Münster in W., November 1, 1914.

The writers summarise the data obtained by many analists regarding the ferric oxide content of milk and the manner in which the latter is affected by feeding iron or iron compounds, such as the saccharate, phosphate, etc., to cows, or by injecting rabbits and goats with a solution of ferrum citricum (citrate of citro-ammoniacal iron).

In view of the contradictory results obtained by administering iron, or iron compounds to milk-producing animals, the writers carried out new experiments with 3 cows in different periods of lactation. The animals received daily, 140 gms. (5 oz.) of saccharate of iron containing 10 per cent of iron ; the compound was administered in the form of solution for 14 days and in the form of powder for another 14 days. The results led to the conclusion that normal cow's milk contains from 0.03 to 0.13 mgm. of ferric oxide per 100 cc. of milk (generally between 0.03 and 0.07 mgm). This amount increases towards the end of the lactation period, but is not increased by feeding saccharate of iron to the cows.

322 – **The Prophylactic Examination of Meat by Means of Feeding Experiments with Mice.** — MULLER, in *Zeitschrift für Infections Krankheiten und Hygiene der Haustiere*, Vol. 16, Fasc. 3, pp. 113-137. Berlin, November 10, 1914.

Considering not only the results of his own work but also those of other investigators, the writer draws the following conclusions :

1. Perfectly healthy mice must be used in all feeding trials of which the object is the prophylactic examination of meat.

2. No mice should be used which are infected with the bacteria of paratyphus or of the Gärtner group even though the infection be a latent one, for on a meat diet the latent form might well be transformed into the acute form and wrong conclusions might be drawn as to the quality of the meat.

3. If perfectly sound mice are used, the results, so far as the presence of toxic bacteria in the raw, cooked or salted meat is concerned, can be accepted as reliable.

4. The experiments do not merely have for their object to determine the presence of toxic bacteria in the meat, but also, by the differential diagnostic method, to settle the question whether pure cultures of bacteria isolated from meat can by inoculation produce toxic substances resistant to heat in an experimental sample of meat.

5. There is no way other than that of feeding mice with the meat to determine the presence of toxic substances in butcher's meat.

6. If the experiments are not made with due care it might happen that even with perfectly sound mice, toxic properties, not really exist-

ing in the butchers meat, might be detected. This would be specially the case if the animals had been subjected to cold or damp.

7. Glass cages, are not suitable for housing mice unless resting on a plank which is a bad conductor of heat, and unless the glass walls be kept at a uniformly warm temperature.

8. If the experiment is carried out carefully in all details the mice will in 12 to 18 hours consume such a large quantity of the meat as to make it possible to draw safe conclusions with regard to the presence or absence of toxic substances in the meat under trial.

9. If the butcher's meat does contain toxic substances a very small quantity of it, raw or cooked, will suffice to cause the death of the mice in a short time.

10. The prophylactic examination of the meat is incomplete without recourse to mice feeding as otherwise the presence or absence of toxic substances resistant to heat cannot be determined.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

323 – **Town Smoke and Plant Growth** (1). — I. CROWTHER, C., and RUSTON, A. G., — II. CROWTHER, C., and STUART, D. W., (Leeds University) in *The Journal of Agricultural Science*, Vol. VI, Part 4, pp. 387-394 and 395-403. Cambridge, December 1914.

I. Six stations were selected in and about the city of Leeds representing a gradation of conditions from the extreme of atmospheric pollution in the heart of the industrial area to the cleaner regions about six miles out of the city. A quantity of soil was taken from a field and used for filling 18 large wooden buckets each holding about 100 lbs. of soil. In each centre three of these buckets were sunk in the soil of a garden or open place, and in them three crops: *i. e.* radishes, lettuces and cabbages, were grown, harvested and weighed during the seasons 1911-1912. The relative weights of the crops obtained are given in Table I.

TABLE I. — *Comparative crop results at the six different stations.*

Station	Degrees of atmospheric pollution as measured by total sulphur in annual precipitation (expressed as SO_3)	Relative weight of crop			Rel. sulphur content of dry matter		
		Crop:			Crop:		
		I	II	III	I	II	III
	lbs. per acre						
1. Industrial area	215	46	31	15	142	210	211
2. Heart of city	197	49	40	37	156	171	171
3 One mile north	134	60	74	89	112	130	148
4. Two » »	103	90	86	122	111	132	129
5. Three » »	73	100	100	100	100	100	100
6. Six miles east	91	80	125	47	106	78	101

(1) See also *B.* Dec. 1913, No. 1321. (*Ed.*).

The results indicate a fairly close correlation between the relative degree of atmospheric purity and the actual amount of plant growth obtainable ; the atmospheric impurities are also reflected in the sulphur content of the crop. There is evidence, moreover, that the effects are cumulative, as the results at Station 1, become worse with each succeeding crop.

In the autumn of 1913, after the experiment had been running three years, samples of the soil from each station were examined chemically and bacteriologically with the results set out in Table II.

TABLE II. — *Analyses of soil after three years' exposure in the different stations.*

Station	Calcium carbonate in soil	Nitrogen as nitrates	Total no. of bacteria per gm. of dry soil	Ammonia produced from peptone	Ammonia converted into nitrates	Nitrogen fixed per gm. of mannite
	per cent	parts per million	thousands	mgms.	mgms.	mgms
1	0.12	1.2	876	64	1.2	15
2	0.17	0.8	798	67	1.9	18
3	0.19	1.9	1 054	78	4.3	19
4	0.26	3.4	1 236	88	6.4	21
5	0.30	4.6	1 536	105	8.7	26
6	0.34	5.1	1 420	95	10.6	23

These results indicate clearly that the detrimental effect of the smoky atmosphere on plant growth is partly due to unfavourable changes in the soil, such as the steady depletion of the stock of calcium carbonate and the inhibition of the activities of the nitrogen-adapting bacteria.

II. In continuation of their former experiments, the writers grew crops at different points around the city of Leeds to compare the growth obtained at a 4 and 7 mile radius from the centre of the city. The results, though irregular, showed an average difference of 20 per cent in favour of the stations on the 7 mile circle. General observations were also made on trees and vegetation and on the effect of the polluted atmosphere on farming in general, showing the disadvantages under which the farmer and the horticulturist in the neighbourhood of a large manufacturing city have to work.

DISEASES DUE DO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

324 – **Contribution to the Mycological Flora of Austria-Hungary** (1). — BAUDYS, ED., in *Österreichische botanische Zeitschrift*, Year LXIV, No. 12, pp. 482-486. Vienna, December 1914. GENERALITIES

A list of 50 species and one variety of micromycetes collected for the most part in Dalmatia, but also in Galicia, Carinthia, Croatia and the Tyrol.

1) See also *B.* Aug. 1914, No. 788. (*Ed.*).

The following are new to science: *Septoria anthyllidis* n. sp. and *Cercospora radiata* Fuckel var. *dalmatica* n. var., both found on the living leaves of *Anthyllis dillenii* Schult. var *tricolor* Vuk., at Bavšič near Cattaro.

A number of the species enumerated were frequent parasites of commonly-grown or useful plants.

325 – **The Possibility of *Cronartium ribicola* Over-wintering on Currant** (1). — STEWART, F. C. and RANKIN, W. H., in *New York Agricultural Experiment Station, Bulletin* No. 374, pp. 41-53, plates I-III, 1 map. Geneva, N. Y., 1914.

Cronartum ribicola Dietr., known in its aecidial from as *Peridermium strobi* Kleb., is already known to attack the trunk and branches of species of *Pinus* with leaves in fascicles of five, of which the chief is the white pine (*P. strobus* L.), on which it produces the so-called blister rust. The uredospore and teleutospore stages of the fungus are developed on the under surface of the leaves of wild and cultivated species of *Ribes*, producing the felt-rust. The first outbreak of the fungus in America occurred on black currants in the grounds of the Agricultural Experiment Station at Geneva (New York) in the autumn of 1906. Outside the Station grounds only a single affected leaf was found ; this led to the suspicion that the outbreak originated on the Station grounds. As the few five-leaved pines in the immediate vicinity appeared healthy, it was suspected that the fungus had been introduced with some *Ribes* plants imported from England two years previously. Accordingly, the entire plantation was dug up and burned in an attempt to eradicate the disease.

During 1907 and 1908 no trace of *Cronartium* was seen, and in September 1909 only a single affected leaf of red currant was found in a plantation half a mile away ; during 1910 none was found. In August 1911 a second outbreak occurred on red and black currants at the Station, and in the autumn of 1912 there was an epidemic of the rust at Geneva.

As no trace of blister-rust could be found on any of the white pines in the neighbourhood, it was suspected that the fungus might over-winter on currants.

In 1912 attempts were made to resolve this question and diseased black-currant bushes were planted under glass, after leaf fall, and forced into growth during the winter. Others were treated similarly by Drs. J. C. ARTHUR, Lafayette, Indiana ; G. E. STONE, Amherst, Massachusetts ; G. P. CLINTON, New Haven, Connecticut ; and PERLEY SPAULDING, Washington, Dstrict of Columbia. In all some 500 bushes grown under glass showed no trace of the disease at any time through the growing-season.

Inoculation experiments were also carried out in four glass-houses by means of affected currant leaves of *Ribes* which had wintered in the open ; in no case did this teleutospore material give infection.

In agreement with ARTHUR and SPAULDING, the writers consider that these experiments do not prove conclusively that *Cronartium ribicola* never over-winters on *Ribes*. If over-wintering does occur it is probably very

(1) See also *B.* Nov.-Dec. 1911, No. 3243 ; *B.* Feb. 1913, No. 182. (*Ed.*).

rare and only takes place under exceptional conditions. It is therefore not considered necessary to adopt measures against currant bushes infected with the disease, except that they should not be shipped until the leaves are all off.

The discovery near Geneva on May 14, 1913, of two specimens of *P. strobus* attacked by the disease will account for the all the outbreaks of currant rust at Geneva ; and observations during the 1912 epidemic show that in the uredinial stage, *Cronartium ribicola* readily spreads from one black currant plantation to another.

DISEASES OF VARIOUS CROPS

326 – ***Puccinia oryzae* Parasitic on Rice in the Ebro Delta, Spain.** — FLORENSA Y CONDAL, JOSÉ, in *Sindicato de Riegos del Delta Derecho del Ebro, la Enfermedad del Arroz (Puccinia Oryzae)*, 32 pp., figs. Tarragona, 1914.

Towards the middle of July 1914, the rice crops in the right delta of the Ebro were seriously affected by a disease which the researches of the writer attribute to the presence of *Puccinia oryzae*. The development of the fungus had apparently been favoured by: soil fatigue, owing to the same crop having been grown in the fields for several years ; the high level of the water, which had caused the beginning of asphyxiation ; the use of seed that had not been carefully selected and had not been subjected to preventive disinfection ; fertilisers containing an excess of nitrogen and deficient in phosphates, potash and iron ; persistent humidity; want of heat from germination to flowering of the rice ; and finally to the presence of weeds and the insufficient space between the individual rice plants.

The four varieties cultivated in the district, all more or less injured by the disease, are Ostiglia, Bomba, Pesetero and Benlloch.

The parasite has destroyed about 7.5 per cent of the total crop, which represents a monetary loss of about £9 330.

Remedial measures, besides being very costly, were not practicable in the case in question.

As regards preventive measures (which to be efficacious must be carried out at the same time and in a uniform manner by all the persons interested), the writer recommends the burning of all the vegetation existing on ground where rice has been grown, whether it has been invaded by the disease or not. If it is wished to use the straw first, the latter should be at once removed far from the field and the stacks watered copiously with a solution of sulphate of iron, or preferably with a 4-5 per cent solution of sulphate of copper, or else with milk of lime.

After the vegetation remaining on the land has been burnt, a second disinfection should be carried out in the case of infected fields by mixing with the soil 4 cwt. of ammoniacal liquor, or 12 cwt. of lime, or 175 gallons of carbon disulphide per acre ; the last is too expensive for use on a large scale. The level of the water should, as far as possible, be kept below 7 or 8 inches.

Further, it is advisable to choose the most resistant varieties of rice. The Benlloch, though good, seems at present to be beginning to degenerate. The results of two years trials have shown that the Japanese varieties Shiraigho, Onsen, Oba and Kitashawa combine, more or less, the requisite

qualities. In addition, rigorous selection must be practised, even in the case of the seed of selected varieties; this work should be carried out exclusively by special Institutes.

As a general rule, seed from infected land should never be used; if this cannot be avoided, it is necessary to soak the seed for 6 hours in ordinary water and then to put it for 10 minutes in water at 54° C. (129° F.). Seed harvested on land completely free from the disease should be properly disinfected before sowing, by immersing it for 8 or 10 hours in a ½ per cent solution of sulphate of copper, a 2-3 ‰ solution of sulphuric acid, a solution of formalin (2 ½ lbs. to 100 gallons of water) or in milk of lime (10 lbs. of quicklime in 100 gallons of water). The seed should then be dried, or it may be sown at once.

The reduction of the water level will also decrease the surrounding humidity; in addition care should be taken to let the air circulate freely everywhere; to this end it is necessary to destroy the weeds growing on the embankments, etc.

In addition to destroying the weeds which may serve as hosts to the fungus, it is advisable to see that the rice plants grow, according to the varieties, at a distance of 10 to 14 inches apart.

In conclusion, the writer recommends an occasional change of crop, where possible, or at any rate a change of variety from year to year.

327 – **Sorghum Smut *(Sphacelotheca sorghi)* in South Africa.** — Pole-Evans, I. B., in *The Agricultural Journal of the Union of South Africa*, Vol. VII, No. 6, pp. 811-814, 1 plate. Pretoria, 1914.

Although, according to the writer, *Sphacelotheca sorghi* (Lk.) Clinton is common throughout South Africa as a parasite of Kaffir corn (*Sorghum vulgare* Pers.), it does not seem well known to the farmers, who seldom take any means to prevent its occurrence. This smut attacks Kaffir corn when this is still young and remains concealed in the tissues of its host until flowering, causing then a singular deformation of the ovaries and preventing fructification.

The best measures to prevent the attacks of the parasite are those already employed in the control of smuts of other cereals, and consist in treating the grain required for sowing with formalin, hot water, or a solution of sulphate of copper, with a view to killing all fungus spores adhering to the seeds.

328 – **The Black-Dot Disease of Potatoes (*Vermicularia varians*) in South Africa.** — Doidge, Ethel M. (Mycologist, Division of Botany), in *The Agricultural Journal of the Union of South Africa*, Vol. VII, No. 6, pp. 879-882, 1 plate. Pretoria, June 1914.

A disease of potatoes caused by *Vermicularia varians* Duc., not hitherto reported in South Africa, was found in some plots of potatoes grown for experimental purposes in ground adjoining the laboratory of the Division of Botany at Pretoria.

The fungus was first described by Ducomet in France in 1909 as causing a disease of potatoes and tomatoes known as "dartrose". In 1910 Massee referred to it as "French potato-scab", but the writer adopts the

name of "black-dot disease", used by MAC ALPINE, who found it on potatoes in Australia, as at once suggesting the typical appearance of the affected plants.

The symptoms of the disease appear somewhat late in the season. At Pretoria, the first symptoms were observed when the plants were just beginning to flower. The stems lose their fresh, green colour, the lower leaves fall off, and later the whole plant falls over, as the lower portion of the stem is attacked first. The disease then spreads to the upper parts of the stem and to the roots, and eventually the whole plant becomes brown and dry and quite brittle. On close examination, it is found that the surface of the stem is covered with the minute black dots characteristic of the disease. The black dots make their appearance first and are most conspicuous on the lower part of the stem just above and a short distance below the surface of the soil. From there they spread in both directions and may even be found on the leaves and leaf-stalks. As the stem dries it becomes hollow, and black dots develop also in the interior, but only below the ground level. They spread along the underground branches and so reach the tubers.

The disease is not very conspicuous on the fresh tubers; there is frequently a fair crop of apparently sound and well developed tubers; but when the plants are attacked before the tubers are fully formed, the potatoes are undersized and do not mature. In the infected plots at Pretoria a large number of the tubers were not much bigger than walnuts.

Even when a fairly good crop is obtained from diseased plants, the apparently healthy tubers are almost certain to be infected, and it is often possible to find the skin of fresh tubers covered with minute black dots. These are at first only visible after a close examination, or may not be present at all; but after the potatoes have been stored and a certain amount of desiccation has taken place and the surface is roughened, the minute black points become more conspicuous and clearly visible to the naked eye.

In certain kinds of potatoes, in which the skin normally peels off in small flakes, the black points are removed with the flakes, and it then becomes difficult to determine the presence of the disease without microscopic examination of sections of the skin.

The small black dots which cover the skin of the affected plants are the most conspicuous symptom of the disease, but only represent one phase in the life-history of the fungus. Earlier on small white tufts of mycelium develop on the stem; these produce abundant hyaline conidia, which are capable of infecting healthy plants. In the tissue of the skin below these tufts are developed the sclerotia of the fungus; these are crowned with a number of dark, rigid hairs which are somewhat swollen at the base and taper towards the apex. The sclerotia ultimately burst through the skin of the stem and appear on the surface, giving the plant its dotted appearance. According to DUCOMET the sclerotia produce pycnidia, but this stage has not yet been observed in South Africa.

The first and most obvious effects of the attack of the fungus are the drying and death of the tops; if this occurs before the tubers are mature

their growth is arrested. The tubers appear firm and sound, even when the sclerotia are formed on the skin; but if an infected tuber is used for seed, the mycelium may pass into the young tubers and destroy them. Land which has previously carried an infected crop contains sclerotia which are able to remain in the soil and infect the new crop.

All dried haulms should be collected and burnt to prevent the spread of infection. Tubers from infected crops should not be used for seed. Neither potatoes nor tomatoes should be grown in soil which has borne a diseased crop, to avoid infection from the sclerotia in the soil; some non-susceptible crop should be taken, as it is not yet known how long the sclerotia retain their vitality.

329 – **The Destruction of Chestnuts and Oaks by *Armillaria mellea* in the United States.** — LONG, W. H. – in *Bulletin of the U. S. Department of Agriculture*, No. 89, pp. 1-9, plates I-II. Washington, February 1914.

In the neighbourhood of New Berlin in the county of Chenango (New York State) and at Brin (South Carolina) chestnuts are suffering severe damage; this is seen in the meagre growth during recent years, in the thin sap-wood, in the large proportion of diseased heads, in the drying of the tips of the branches and in the large number of trees dead or dying. This destruction is probably due to several factors, one of which is represented by *Armillaria mellea* Vahl, a well-known Agaric causing root-rot. It should be noted that *Endothia parasitica* (1), the cause of the chestnut-bark disease, has not been recorded in the above localities.

According to the writer *A. mellea* under favourable conditions may become an active parasite, especially on chestnut and oak. It not only destroys fallen trees in the forests, but also those grown under the most favourable conditions.

The prevalence of *Armillaria mellea* and its destructive action in South Carolina appear to indicate that it is one of the factors having an important influence on the gradual disappearance of the chestnut from this State.

WEEDS AND PARASITIC FLOWERING PLANTS.

330 – ***Loranthus* spp. on *Hevea brasiliensis* in Negri-Sembilan and Pahang, F. M S.** (2). — BROOKS, F. T., in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 1, pp. 7-9. Kuala Lumpur, 1914.

In supplementing his previous account (3) the writer adds that the two species of parasitic plants recorded in a plantation of *Hevea brasiliensis* in the State of Negri-Sembilan belong to the genus *Loranthus*.

The presence of a small number of these parasites has also been recorded in some other plantations in the same State. One species of *Loranthus* was also observed in 1911 on the same host plant in the State of Pahang.

(1) See *B.* Nov. 1914, No. 1074.
(2) See also *B.* April 1912, No. 478.
(3) See *B.* Dec. 1914, No. 1190. (*Ed.*)

Some authorities do not consider that these parasites cause serious damage to *Hevea*. According to the writer this is owing to the fact that they have not appeared to any great extent in any one plantation. However, individual specimens of *Hevea* carrying large amounts of the parasites have shown considerable disturbance. Their strong development on *Hevea* causes a general weakening of the host and a decrease in the yield of latex. They should therefore not be allowed to grow unchecked. All branches attacked should be removed as soon as the existence of the parasite has been observed, care being taken to cut them well beyond the seat of the parasite, so as to prevent its subsequent growth.

Numerous species of *Loranthus*, disseminated by birds, are very widespread in the tropics and generally occur on several hosts. A *Loranthus* occurring on *Hevea* has also been seen on a common specie of *Melastoma*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

331 – **Experiments in the Control of Woolly Aphis *(Schizoneura lanigera)* by Duval's Method** (1). — LIÈVRE, in *Journal de la Societé nationale d'Horticulture de France*, 4th Series, Vol. XV, pp. 516-519. Paris, 1914.

Under the supervision of a special Commission, to which the writer was appointed Reporting-Secretary, M. CELESTIN DUVAL carried out on August 19, 1913, at Boulogne-sur-Seine, experiments in controlling woolly aphis. He used for the purpose a liquid insecticide prepared by himself, whose composition he kept secret. An apple tree covered with colonies of this aphis was sprayed with the insecticide; after about an hour, all the insects reached by the liquid were dead, while no signs of scorching were observable on the leaves. On other trees treated in the same way eight or ten days previously, there were no living aphids to be seen, nothing remaining but traces of the insects reduced to ashes. It thus seemed, in the opinion of the Commission, that the method was efficacious and practicable.

Being free from all necessity for reserve, M. DUVAL made known in 1914 the composition of his insecticide. According to the prescription of the inventor the following solution must be use in case of leaves, young shoots, or wood of several seasons, during the growing season.

Formula I.

Rain water	10 gallons
Carbonate of potash	6 ½ oz.
Sulphoricinate of soda	4 lbs.
Methylated spirit	2 lbs.
Strong extract of tobacco (10 %)	1 lb.

(1) See also *B.* March 1913, No. 324; *B.* Sept. 1913, No. 1124; *B.* June 1914, No. 587. (*Ed*).

The spray gradually dissolves the waxy coating of the aphids, so that finally all of them (females and young) are turned into a sort of dense paste, which soon dries up and becomes of a greyish colour.

During the last two or three weeks of the vegetative period, when the leaves are about to fall naturally and there is no fear of harming them, the following stronger solution is used if there are still any aphids:

Formula II.

Rain water	10 gallons
Potash from ashes	1 lb. or 19 oz.
Sulphoricinate of soda	4 lbs.
Strong tobacco extract	2 lbs.
Methylated spirit	2 lbs.

Although the insects are at this time encased in a thicker and less permeable wax envelope, they cannot resist the action of this mixture.

The time comes when the sexual and fertilised females lay their winter eggs. In order to destroy the latter, all the holes, crevices, and cavities of the cortex are painted over with the following composition.

Formula III.

Rain water	10 gallons
Soft soap	35 lbs.
Sulphoricinate of soda	5 lbs.

Finally, to destroy the aphids in their last refuge, which is the roots, on which the sexual females assemble after having laid their eggs, a kind of basin is excavated round the foot of the tree so as to expose the roots on which the insects have gathered ; then they are well watered with the solution of formula I, or if necessary, formula II. As sown as they are seen to be dead, the basin is filled in.

M. DUVAL believes that if these different prescriptions are followed, woolly aphis will disappear from the trees of a plantation ; and without being too sanguine, one may even foresee the possible destruction of the species, provided the method be adopted and practised everywhere.

332 – **Results of the First Experiments with Polysulphides strengthened with Flour Paste in the Control of *Chrysomphalus dictyospermi* var. *pinnulifera* on Citrus Trees** (1). — DEL GUERCIO, G., in *Rivista di Patologia vegetale*, Year VII, No. 5, pp. 129-135. Pavia, 1914.

The writers gives a preliminary report of experiments made in 1914 for the purpose of destroying *Chrysomphalus dictyospermi* var. *pinnulifera* (Mask.), the scale insect which is so destructive to citrus trees and is known in Sicily as " bianca-rossa ".

He found that it was very efficacious to add to the insecticides (polysulphides) 1 or 2 per cent of flour paste, fish glue, etc. Rye flour is, at the

(1) See also *B.* Feb. 1911, No. 688; *B.* Aril 1911, No. 1312; *B.* June 1913, No. 765. (*Ed.*).

present moment, the flour which answers best: besides being inexpensive, it makes the most tenacious paste; but spoilt wheat flour and flour from various other seeds can also be successfully used.

Whatever organ of the plant is affected, and whatever its state of development or its position on the plant, it is always completely and uniformly wetted with insecticides thus prepared. Further, the protecting shields of the scale insect remain as if glued to the organs of the plant, so that the larvae and eggs perish beneath the mother scale.

According to the writer, the most active polysulphide is that of potash, even in amounts of less than 1 per cent in the control of the larvae, and at 5 to 7 per cent in the case of the males and females of *Chrysomphalus*; in July its action is so rapid that the injury it causes to the adult insect is apparent from the second day, while the larvae are destroyed almost instantaneously. This polysulphide, when strengthened with flour, owes its increased destructive property to its great hygroscopicity: thus, during the night and early morning it absorbs moisture from the air, and its injurious effects on the scale insects are renewed, while during the day and until night-fall, with the warm air, its action is lessened. This circumstance is most fortunate, since it is thus easy to avoid scorching and injury from the sun's rays, which easily takes place in the southern parts of Italy and especially in Sicily. This liquid, however, loses its efficacy if the plants are washed by heavy rains immmediately after spraying.

Polysulphide of soda is much less effective than the potash compound; the impurities which accompany it also prevent its use.

Polysulphide of lime alone does not adhere well to very young shoots and leaves, or to green branches or fruit; it adheres better to old citrus leaves, but never wets them evenly. When strengthened with glue or flour it has never the swift effect of polysulphide of potash, nor is it so effcacious, being deficient in the latter's hygroscopic property and not giving rise to the same chemical changes. On the other hand, it retains its protective action longer, since it is less easily washed off by rain.

The writer has also experimented with double polysulphides strengthened with flour; these he obtained by mixing together the polysulphides of potash and lime, plus the viscous substance. These polysulphide mixtures possess the properties mentioned in the case of their ingredients. The writer also calls attention to organic polysulphides prepared from polysulphide of potash and soap; they are apparently as efficacious insecticides as polysulphide of potash with flour paste, but their protective action does not last as long as with the latter or polysulphide of lime.

Some citrus growers have already adopted these methods, using especially polysulphide of potash with flour paste.

BIBLIOGRAPHICAL NOTE.

333 – BERLESE, ANTONIO (Director of the Royal Station of Agricultural Entomology, Florence). — *La distruzione della « Diaspis pentagona » a mezzo della « Prospaltella berlesei »* (Destruction of *Diaspis pentagona* by means of *Prospaltella berlesei*). Florence, M. Ricci, 1914 (pamphlet, 16mo, 70 pp.).

In this pamphlet, the writer gives an account of the different phases of the very important question of the destruction of *Diaspis* by the parasite *Prospatella berlesei* (Hymenoptera), which he discovered in 1906 after careful research (1). Having discovered the cause of the death of a large number of the scales sent from the United States, whither unwittingly MARLATT had imported the parasite from Japan, Prof. BERLESE devoted himself to propagating it in Italy, and abroad. The results of his work, which have been confirmed by numerous workers, prove that *Diaspis* is conquered.

In the pamphlet in question, the author has given an account of the introduction of *Diaspis* into Italy, and the legislative measures taken for its control. He speaks of the damage it caused to the mulberry tree, describes the propaganda employed to get the new control method adopted, and the previous means used for the destruction of the pest. The " prospaltisation " method is described and favourable opinions given by agricultural institutions, growers and Italian and foreign experimenters are quoted. In conclusion, Prof. BERLESE briefly mentions the favourable results obtained by this method of control in Uruguay, Argentina and Switzerland.

INSECTS INJURIOUS TO VARIOUS CROPS

334 – ***Eremnus fulleri, Tychius gossypii, Hyperoides fragariae* and *Cyllophorus rubrosignatus*, New Coleoptera Injurious respectively to Maize, Cotton, Strawberry and Fig, in Africa.** — MARSHALL, GUY A. R., in *Bulletin of Entomological Research*. Vol. V, Part 3, pp. 235-239, figs. 1-3. London, December 1914.

Systematic descriptions are given of the following Coleoptera :

1) *Eremnus fulleri* sp. nov., the adult of which attacks the leaves of the maize ; it has been found at Wepener in the Orange Free State.

2) *Tychius gossypii* sp. nov., found on cotton at Cairo, Egypt.

3) *Hyperoides fragariae* gen. et sp. nov., found damaging strawberries at Rosebank, in the Cape Province; this is the first species of the subfamily *Hyperinae* recorded from South Africa.

4) *Cyllophorus rubrosignatus* sp. nov., injurious to cultivated fig trees at Malvern and Howick in Natal.

335 – ***Mometa zemiodes*, a New Moth Injuring Cotton Seed in Southern Nigeria.** — DURRANT, JOHN HARTLEY, in *Bulletin of Entomological Research*, Vol. V, Part 3, p. 243. London, 1914.

A systematic description is given of the new genus *Mometa*, belonging to the family *Gelechiadae*, and represented by the species *M. zemiodes* Durrant. This new African moth was discovered at Ibadan, Southern Nigeria, in 1913, in cotton seed, on which its larvae feed.

(1) See original article: « The Control of the Japanese Fruit Scale (*Diaspis pentagona*) in Italy », by Prof. ANTONIO BERLESE. — *B.* May 1913, pp. 697-703. (*Ed.*).

336 - ***Duomitus armstrongi* and *Melisomimas metallica*, Lepidoptera observed respectively on *Coffea* sp. and *Albizzia* sp. in West Africa.** — HAMPSON, GEORGE F., in *Bulletin of Entomological Research*, Vol. V, Part 3, p. 245, plate XVII (figs 8). London, December 1914.

The writer describes from a systematic point of view as new to Science the Lepidoptera *Duomitus armstrongi* and *Melisomimas metallica*. The larva of the first, found at Aburi (Gold Coast), was boring into coffee stems ; the second was obtained in the perfect state by rearing the larvae which bore into the cortex of an *Albizzia* in Southern Nigeria (Ibadan district) ; it has also been found at Sierra Leone.

337 - **The Euphorbia Flagellate (*Leptomonas davidi*) in Italy.** — VISENTINI, ARRIGO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, 1914, 2nd Half-year, Vol. XXIII, Part 12, pp. 663-666, figs. 1-6. Rome, January 1915.

LAFONT described in 1909, under the name of *Leptomonas davidi*, a flagellate found in Mauritius in the latex of *Euphorbia pilulifera*, *E. hypericifolia* and *E. thymifolia*, which he considered to be the cause of a real disease of these plants, for which he proposed the name of " flagellosis ".

In 1910-11, the same protozoon was observed in many other tropical regions on the three above-named *Euphorbiae* and on *E. indica* (1), while in Portugal it was recorded on E. *peplus* and *E. segetalis*.

Still more recently, in May 1914, it was recorded in the neighbourhood of Sassari, Sardinia, on *E. schimperiana* Hochst. and *E. cupani* Guss. Finally, in the month of July of the same year, the writer discovered this *Leptomanas* in the latex of *E. segetalis* near Castel S. Pietro dell'Emilia (Prov. of Bologna).

Amongst the typical forms of this protozoon, the writer found others which were non-flagellate; these were much rarer, and suggested a form of *Leishmania*.

338 - **The Wavy-striped Flea-Beetle (*Phyllotreta sinuata*), on Garden Crops in Canada.** — DUPORTE, MELVILLE E., in *The Canadian Entomologist*, Vol. XLVI, No. 12, pp. 433-435, figs. 36-38. London, Ontario, December 1914.

Phyllotreta sinuata Steph., known as the wavy-striped flea-beetle, whose life-history is briefly described, had not been previously recorded as injurious in Canada. The writer's attention was first directed to it in June 1913, when the larvae were observed boring in the leaves of cress and feeding on the leaves of radish in a garden at Macdonald College, Quebec.

Adults were obtained in the open and also by rearing the larvae. Cress was attacked by both adult and larval forms.

The pest was also observed in 1914 in the same place, living on turnips and cabbages as well as radishes. It is often associated with the turnip flea-beetle (*P. vittata* Fab.) and it is probably on account of its close resemblance to this species that it has escaped observation in Canada.

(1) The *Index Kewensis* gives *E. indica* Lam. = *E. hypericifolia* L. and *E. indica* Wall. = *E. rosea* Retz. (*Ed.*).

P. sinuata should be regarded as an introduced species in Canada. It is generally distributed in Europe, and has also been recorded on several occasions in the United States.

339 – ***Chortophila trichodactyla* (Diptera), Injurious to Young Cucumber Plants and New to Lower Silesia.** — OBERSTEIN, O., in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Year 1914, Part 7, pp. 385-388. Stuttgart, 1915.

Young cucumber plants which were being destroyed by some animal agent were sent for examination from two localities in Lower Silesia in May 1913 and 1914 to the Experiment Station of Agricultural Botany of the Chamber of Agriculture of Silesia, at Breslau.

At Lampersdorf (district of Steinau a. d. O.) the infected plants amounted to about 80 per cent in the ½ acre field whence the specimens were sent. The land had been heavily dunged. According to the information given by the sender, the seedlings died after a few days and their stalks harboured small larvae. In neighbouring fields few plants were injured ; a very late replanting of the damaged patches turned out fairly well.

The writer was able to ascertain that at the base of the hypocotyl of the seedlings there was a small hole which gave access to a gallery running in the direction of the length of the stalk, in the interior of which was a yeollwish-white larva. The latter caused the withering of the hypocotyl and subsequently the death of the whole plant, though the cotyledons still remained fresh and green for some time.

In 1913 and 1914, the writer reared the larvae found in the seedlings. Pupation took place in the soil, and in 1913 began on May 31. From June 9-12 of the same year the adult insects made their appearance ; all were females, as were others obtained on June 12, 1914. According to the determination of Prof. STEIN, of Treptow a. d. Rega (Pomerania), these insects belong to the Anthomyid *Chortophyla trichodactyla* Rond., whose life-ihstory is not yet perfectly known. The insect is new to Lower Silesia, where no fly had been recorded as attacking cucumbers.

As the members of the *Anthomyidae* are usually attracted by pungent odours, it would be well, in order to prevent the attacks of *C. trichodactyla*, to avoid using fresh stable manure. Experience will show whether the other methods of control advised in the case of *Anthomyidae* in general, and especially treatment with petroleum emulsions, are efficacious against this *Chortophyla*.

340 – ***Kermes mirabilis* on *Quercus* sp. in California.** — KING, GEO. B., in *Journal of Entomology and Zoology*, Vol. VI, No. 3, p. 133, 1 fig. Claremont, California, 1914.

A systematic description is given of a new scale, *Kermes mirabilis*, found on *Quercus* sp. at Mountain View, California. It is near *R. galliformis*.

341 – ***Megastigmus laricis* (Hymenoptera) Destroying Seeds of *Larix laricina* in New York State** (1). — MARCOVITCH, S., in *The Canadian Entomologist*, Vol. XLVI, No. 12, pp. 435-438, plate XXVII. London, Ontario, December 1914.

In September 1913 the seeds of *Larix laricina* Du Roi, at Ithaca (New York) were found to be attacked by a white larva. From seed kept indoors through the winter, the first adults emerged in the beginning of April 1914. These adults belong to a species of *Megastigmus* which the writer describes as new to Science under the name of *M. laricis*. The larvae completely devour the kernels of the seeds and occupy the entire cavity, so that it becomes difficult to open one of these seeds without damaging the larva. This species differs from *M. atedius* Walker, *M. japonicus* and *M. koebelei* Ashmead.

In the autumn of 1913 the writer found the larvae of *M. physocarpi* Crosby, similar in shape to those of *M. laricis*, in the seeds of *Physocarpus opulifolius* (= *Neillia opulifolia*), belonging to the Rosaceae.

BIBLIOGRAPHICAL NOTE.

342 – SLINGERLAND, MARK VERNON, and CROSBY, CYRUS RICHARD. — *Manual of Fruit Insects*. New York, The Macmillan Co. 1914 (1 Vol., 16mo., [pp. XVI + 503 and 396 figs.).

Mr. C. R. CROSBY, of the New York State College of Agriculture at Cornell University, Ithaca, has arranged and completed the manuscript begun in the autumn of 1908 by the late Prof. M. V. SLINGERLAND, who for about twenty years, and until his death (March 1909), had specially devoted himself to the study of entomological problems connected with fruit growing in the State of New York.

The result of this collaboration is a manual, which, after giving some general ideas on the subject, passes on to a separate description of the most important insects and of certain arachnids occurring in the United States on fruits (apple, pear, quince, plum, peach, cherry, raspberry, blackberry, currants, gooseberry, strawberry, vine, cranberry, etc.), omitting intentionally a large number of less important pests.

For each of the species mentioned, amounting to about two hundred, brief information is given respecting distribution, habits and life-history, as well as the extent of its ravages and the control methods. To the description of each species are added bibliographical notes, almost exclusively American.

The book concludes with a short chapter on the most commonly used insecticides.

(1) See also *B.* Feb. 1911, No. 495; *B.* May 1913, No. 623. (*Ed.*).

ALFREDO RUGGERI, *gerente responsabile.*

THE INTERNATIONAL MOVEMENT OF FEEDING STUFFS.

No. 1. *April* 1, 1915.

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INTRODUCTION.

As a result of a discussion which took place at the last General Assembly of the International Institute of Agriculture (INSTITUT INTERNATIONAL D'AGRICULTURE, IV^ème^ *Ass. gén.*, décis. 11, Pioda-Laur, 1913), the Permanent Committee decided to publish an Annual Review of the International Movement of Feeding Stuffs on April 1st. of each year.

This first attempt to gather together world statistics on feeding stuffs is the counterpart of the analogous publication on fertilizers (INST. INT. D'AGR. *Production et consommation des engrais chimiques dans le monde*).

In the present number the data for each country are treated separately. In the next number the different classes of products will also be tabulated to show the world's production, the international commerce and the consumption in the different countries. By this means more complete information will be obtained about various tropical products, such as oil seeds and fruits, from which feeding cakes are obtained. The cakes derived from inedible seeds are treated in the Fertilizer Review.

The data have been collected in part directly by the Institute and in part from the Governments of the different countries, to whom a circular letter of enquiry was addressed. Information has also been obtained from various private sources. Certain products which are dealt with in the general statistics published by the Institute (*viz.* oats, maize, barley, cereal by-products and linseed) are not included in the present tables unless specially mentioned as being used for feeding stuffs.

All data have been reduced to metric tons.

Germany.

Data collected by the German Agricultural Society respecting imports of concentrated feeing stuffs into Germany are given in Table I (see HOFFMANN, M. *Flugschriften der Deutschen Landwirtschafts-Gesellschaft*, 12,7. Aufl., VII-VIII. Berlin, 1914).

TABLE. I. - - IMPORTS OF FEEDING STUFFS INTO GERMANY 1880-1912.

Feeding stuffs	1880	1890	1900	1910	1911	1912	Exports 1912
	metr. tons	metr. tons	metr. tons	metr. tons	metr. tons	metr. tons	metr. tons
Bran	78 295	318 595	758 047	1 128 693	1 420 717	1 606 250	16 766
Maize	359 454	561 933	1 384 157	573 126	743 420	1 142 459	55
Oil cakes and oil cake meals	47 550	219 031	499 615	713 933	756 772	794 190	263 474
Oil seeds and fruits	210 04[illegible]	371 125	633 526	1 294 992	1 263 022	1 435 317	.....
yielding cakes	10[illegible] 023	185 563	316 762	647 496	631 511	717 659	.....
	+ 47 550	+ 219 031	+ 499 615	+ 713 933	+ 756 772	+ 794 190	.....
Total cakes	152 573	404 594	816 377	1 361 429	1 388 283	1 511 849	.....
Feeding barley	261 941	735 292	781 458	2 826 320	3 477 980	2 756 925	1 156
Oats	178 741	187 717	462 351	457 721	628 308	665 935	383 774
Maize germ meal, rice residues, potato pulp, vinasse, beet slices, wine lees	.....	.....	71 286	340 608	431 322	478 616	14 712
Rice residues calculated from rice imports	.....	.....	.....	70 000	80 000	90 000	.....

The home production of bran is estimated by the Society at an average of 4 million metric tons per annum during the period 1903-1908, and judging from the wheat imports, it should have risen to 5 million tons during 1911-1912. No data are given respecting the production of cakes from home-grown oil seeds, but the following details with regard to the imported oil seeds and fruits are included :

	1880	1890	1900	1910
	metric tons	metric tons	metric tons	metric tons
Linseed	74 121	118 896	267 571	320 522
Palm kernels and copra	47 480	93 346	148 957	398 442
Rapeseed	81 991	110 277	131 914	187 302

The removal of the customs duty on maize bran in 1910 caused the imports of this substance (homco or hominy feeding meal) to rise considerably while those of the whole grain diminished. An appreciable quantity of maize must have been used for distillery purposes during 1911-1912.

Imports of pulse grain during 1912 were as follows :

	1912 — metric tons
Peas	371 195
Beans	255 565
Lupins	13 280
Vetches	25 181

Imports and exports of potatoes and sugar-beets vary from year to year; 178 000 m. tons of hay, straw and green forage were imported in 1912, while 56 727 m. tons were exported.

In Table II are set out general data which give a more comprehensive idea of the movement of feeding stuffs in Germany (see WAAGE, TH. Die Entwicklung des Futtermittel-handels in dem letzten Jahren. *Der Saaten-, Düinger- und Futtermarkt,* Jubiläumsausgabe, 3, 8. December 1913).

TABLE II. — MOVEMENT OF FEEDING STUFFS IN GERMANY, 1888-1912.

Feeding stuffs	1888				1912			
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Bran	1 960 000	370 000	70 000	2 260 000	4 400 000	1 600 000	10 000	5 990 000
Oil cakes	320 000	170 000	50 000	440 000	1 000 000	790 000	260 000	1 530 000
Milling offal, excluding oats and barley	150 000	30 000	.....	180 000	90 000	220 000	.....	310 000
Brewery and distillery residues	10 000	.....	.....	10 000	450 000	210 000	.....	660 000
Sugar and starch factory residues; potato slices	.....	.....	.....	.....	800 000	30 000	.....	830 000
Feeding cereals	5 800 000	400 000	.....	6 200 000	10 000 000	4 000 000	.....	14 000 000
Total	8 240 000	970 000	120 000	9 090 000	16 740 000	6 850 000	270 000	23 320 000
Total, exclud. feeding cereals	2 440 000	570 000	120 000	2 890 000	6 740 000	2 850 000	270 000	9 320 000

German Colonies.

Table III was drawn up from data published by the German Imperial Colonial Bureau (see *Die Deutschen Schutzgebiete*, 1912-13. Amtliche Jahresberichte herausgegeben vom Reichs-Kolonialamt, 1914).

TABLE III. — EXPORTS OF OIL SEEDS AND FRUITS FROM THE GERMAN COLONIES.

Feeding stuffs	1912
	metric tons
Ground nuts (German West Africa)	6 078
Copra (German West Africa, Togo, German New Guinea, Samoa)	32 907
Palm kernels (Kamerun, Togo)	27 638
Sesame (German West Africa)	1 881
Total oil seeds and fruits	68 504
yelding cakes	34 252

Argentine Republic.

TABLE IV is drawn up from the latest published returns of exports and gives some idea of the production of feeding stuffs in the Argentine Republic. Exports of hay are included for comparison.

TABLE IV. — EXPORTS OF FEEDING STUFFS FROM THE ARGENTINE REPUBLIC.

Feeding stuffs	1913
	metric tons
Bran	274 058
Rice meal	2 574
Maize offal	1 656
Oil cakes	20 952
Meat meal	2 744
Linseed	1 016 732
yielding cake	508 366
Hay	*32 346*

Austria-Hungary.

Table V is drawn up from the returns of imports and exports in Austria-Hungary.

TABLE V. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN AUSTRIA-HUNGARY.

Feeding stuffs	Imports		Exports	
	1912	1913	1912	1913
	metric tons	metric tons	metric tons	metric tons
Feeding meals	12	2	780	1 148
Oil seeds and fruits:				
Rape	20 872	30 331	.....	.....
Linseed	45 406	64 152	1 225	920
Hemp	3 160	11 681	.....	.....
Cotton	11 233	3 813	1 498	1 255
Sesame	31 414	26 629	4	455
Palm	39 906	27 043	.....	.....
Copra	45 537	33 305	.....	1
Others	17 674	34 273	1 375	2 889
Total oil seeds and fruits	215 202	231 227	.....	.....
yielding cake	107 601	115 613	.....	.....
Bran:				
Wheat and rye	140 924	147 882	37 183	30 541
Rice	13 876	5 816	15 747	11 079
Others	903	648	5 881	6 448
Malt coombs	2 538	2 194	1 253	845
Chaff	795	452	277	253
Oil cakes:				
Linseed	3 882	4 989	15 304	18 245
Others	29 725	31 235	42 602	32 219
Pulp:				
Distillery	3 421	4 307	325	239
Sugar-beet	13 367	11 277	17 462	18 086
Hay	*13 117*	*80 844*	*36 419*	*65 380*

Belgium.

Belgium is the only country which collects statistics on the home consumption of feeding stuffs. The returns are made with those of the general agricultural census every ten years, the last of which, taken in 1909, provided the data for Table VI (See *Statistique de la Belgique*, Recensement agricole de 1909, Ministère de l'Agriculture, 1910).

TABLE VI. — CONSUMPTION OF FEEDING STUFFS IN BELGIUM.

Feeding stuffs	1908	1909
	metric tons	metric tons
Linseed cake and meal	242 529	237 881
Cotton » » »	17 227	18 785
Other cakes and meals	31 657	35 174
Meat meal	409	613
Malt sprouts, malt coonbs and other malt residues	10 901	11 429
Maize and maize meal	83 198	92 003
Dried brewers' grains	17 888	20 513
Wet brewers' grains	487 116	257 996
Sugar-beet pulp	1 149 576	445 400
Bran and pollards	255 225	1 128 189

Assuming that the whole of the above foods were consumed by cattle, the annual consumption per head has been calculated and is given in Table VII.

TABLE VII. — CONSUMPTION OF FEEDING STUFFS BY CATTLE IN BELGIUM (KG. PER HEAD PER ANNUM).

Feeding stuffs	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909
Linseed cake and meal	—	81.54	91.54	105.46	109.60	110.59	112.21	123.59	130.29	127.84
Cotton » » »	—	8.58	7.60	7.26	7.26	8.22	8.11	8.67	9.25	10.12
Other cakes and meals	—	14.96	15.60	15.78	18.97	16.52	15.93	16.48	17.01	18.94
Meat meal	0.55	0.41	0.53	0.26	0.40	0.27	0.28	0.35	0.22	0.33
Malt sprouts, malt coombs and other malt residues	—	5.40	4.05	4.71	5.20	5.91	7.21	5.74	5.86	6,15
Maize and maize meal	—	33.92	33.19	33.19	38.38	41.13	53.21	50.82	44.70	49.55
Dried brewers' grains	7.94	10.16	8.10	7.49	8.81	10.57	7.90	8.16	9.61	11.05
Wet brewers' grains	—	288.09	342.75	223.88	237.40	238.86	249.48	253.46	261.69	239.87
Sugar-beet pulp	790.67	876.89	624.20	620.21	471.59	694.41	654.64	584.72	617.58	607.59
Bran and pollards	111.17	123 33	127.54	132.28	139.71	142.63	148.75	136.71	137.11	138.84

TABLE VIII. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN BELGIUM.

Feeding stuffs	Imports			Exports		
	1911	1912	1913	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Oil seeds and fruits:						
Rape	99 589	85 022	106 017	55 660	51 125	70 419
Linseed	258 838	223 032	227 556	150 902	149 354	153 278
Unenumerated	131 820	92 856	146 908	45 196	36 305	64 011
Copra	19 544	25 744	33 470	6 957	7 170	10 364
Palmnut	4 265	6 402	2 756	790	565	61
Total oil seeds and fruits	514 056	433 056	516 707	259 505	244 519	298 133
yielding cake	257 028	216 528	258 353	129 752	122 259	149 066
Oil seed cakes	255 952	212 354	240 223	56 810	71 422	79 042
Bran	75 189	55 776	72 016	22 056	42 908	34 229
Other seeds and residues	1 357	1 691	2 628	2 198	2 748	3 132
Roots and forage crops	*191 597*	*195 426*	*190 404*	*97 872*	*130 397*	*131 864*

China.

Exports of feeding stuffs from China are given in Table IX. Imports of all kinds of bran during 1912 and 1913 were 59 368 and 127 582 metric tons respectively.

TABLE IX. — EXPORTS OF FEEDING STUFFS FROM CHINA.

Feeding stuffs	1912	1913
	metric tons	metric tons
Soya bean cake	493 477	714 460
Other cakes	51 066	79 372
Oil seeds:		
Soya	661 004	624 236
Groundnut	51 793	69 224
Cotton	18 598	11 032
Rape	48 723	37 286
Sesame	120 892	123 001
Others	59 044	45 677
Total oil seeds	960 054	910 456
yielding cake	480 027	455 228
Bran	45 098	62 045

Denmark.

TABLE X. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN DENMARK.

Feeding stuffs	1910		1911		1912		1913	
	Imports	Exports of home-grown produce	Imports	Exports of home-grown produce	Imports	Exports of home-grown produce	Imports	Exports of home-grown produce
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Oil cakes:								
Cotton	128 362	.....	172 842	.....	242 856	.....	232 555	.....
Sunflower	89 319	.....	144 288	.....	179 274	587	191 924	717
Groundnut	25 313	90	25 948	.....	24 532	24	35 485	.....
Palmnut	887	.....	806	314	323	452	284	.....
Soya	117 698	7 702	67 938	8 874	13 053	6555	18 515	5 729
Rape	7 398	39	5 874	119	6 336	34	4 328	21
Hemp	35 153	79	68 219	.....	40 171	.....	36 746	.....
Linseed	8 130	588	11 648	59	11 258	272	66 015	147
Cocoanut	114	3 874	67	6 419	10	8.373	2	8 214
Sesame	79	45	.....	403	25	94	15	16
Others	.....	43	.....	40	296	26	6	438
Cotton seed and meal	988	.....	378	.....	403	.....	76	.....
Soya meal	1 000	.....	1 367	.....	1 714	.....	1 747	139
Groundnut husks	889	.....	1 673	.....	3 170	.....	3 545	.....
Crushed palm kernels	1 152	.....	1 277	.....	1 618	.....	1 522	.....
Palm fruit pulp	823	.....	667	.....	386	.....	737	.....
Compound cakes	197	.....	192	.....	354	.....	89	.....
Compound meals	3 423	.....	5 030	.....	5 856	.....	6 904	.....
Wheat bran	40 836	1 281	43 576	14	54 959	662	45 192	425
Rye bran	9	1 988	103	1 710	111	1878	227	3 716
Rice meal	4 238	32	2 340	1	3 380	.....	4 495	.....
Middlings and pollards	2 941	109	3 615	100	3 700	10	2 623	237
Rye and barley meal	182	242	219	120	174	.....	379	10
Other milling by-products	713	965	372	743	563	845	228	903
Maize gluten meal	40	.....	751	.....	306	.....	21	.....
Molassine meal	3 916	3 301	1 478	4 413	2 552	4 622	938	4 261
Molasses, etc., non-edible	761	.....	7	4 865	13	84	9	197
Other compound foods	208	171	41	287	.....	331	313	390
Malt coombs	472	525	435	239	742	166	678	84
Dog biscuits, poultry foods	48	79	18	102	298	79	329	111
Meat meal	.....	228	59	233	56	118	304	104
Total	475 289	21 381	561 228	29 855	598 489	25 212	656 231	25 859

Tables X, XI and XII are drawn up from data furnished by the Danish Office in connection with the International Institute of Agriculture and show the increasing consumption of feeding stuffs in Denmark.

Table XI. — Imports of Oil Seeds into Denmark.

Oil seeds and fruits	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons
Linseed	15 807	8 267	11 641	19 774
Rape	3 995	3 170	3 124	2 145
Cameline	787	61	.....	222
Sesame	5 920	6 397	2 544	4 018
Hemp	1 375	262	205	728
Sunflower	59	908	9 049	2 129
Other oil seeds	.....	14	23	.....
Soya	20 012	35 666	33 981	48 069
Copra	19 885	25 005	24 595	31 144
Palm kernels	.....	1 495	1 773	595
Groundnuts	2 676	2 074	1 188	3 666
Total oil seeds and fruits	70 516	83 319	88 123	112 490
yielding cake	35 258	41 659	44 001	56 245

Table XII. — Consumption of Home-Manufactured Oil Cakes in Denmark.

Oil cakes	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons
Sunflower	40	600	6 000	850
Groundnut	1 250	1 000	500	1 480
Palmnut	.....	400	400	300
Soya bean	9 910	22 500	23 000	34 510
Rape	2 480	1 800	1 800	1 240
Hemp	980	200	200	550
Linseed	10 000	5 600	6 600	13 200
Coconut	7 060	2 000	.....	2 420
Sesame	2 620	2 600	12 000	2 060
Other	510	.....	10	.....

Ottoman Empire.

In Table XIII are collected various heterogeneous data regarding raw materials suitable for the preparation of feeding stuffs. Exports of carobs are chiefly directed to the United Kingdom.

TABLE XIII. — IMPORTS AND EXPORTS OF FOOD MATERIALS IN TURKEY. MARCH 14, 1910 - MARCH 13, 1911.

Food materials	Imports	Exports
	metric tons	metric tons
Vetches	8	925
Sesame seed	354	18 402
Beans, gram, lentils, peas and other leguminous seeds	5 811	49 599
Pips and kernels of fruits and vegetables	590	3 557
Dried fruits, undenominated	4 294	3 276
Leaves, flowers, fruits, berries, seeds, roots, etc., for the manufacture of drugs	2 464	13 683
Flowers, bulbs and flower seeds	54	11 308
Carobs	373	5 661
Straw and bran	1 437	14 927
Meals, undenominated	545	14
Other foods	2 139	1 716

Egypt.

TABLE XIV. — EXPORTS OF OIL SEEDS AND CAKES FROM EGYPT.

Oil seeds and cakes	1913	1914
	metric tons	metric tons
Oil seeds:		
Cotton	472 302	373 703
Groundnut	557	296
Total oil seeds	472 859	373 999
yielding cake	236 429	186 999
Oil cakes	62 977	79 987

United States.

The following data were drawn up by the Bureau of Crop Estimates of the United States Department of Agriculture and communicated by the Committee on Relations with the International Institute of Agriculture.

Table XV. — Production of Cotton Cake and Meal in the United States.

	metric tons		metric tons
1899	801 952	1906	1 620 232
1900	766 571	1907	946 194
1901	1 020 583	1908	1 353 520
1902	1 056 871	1909	1 202 927
1903	1 048 706	1910	1 625 676
1904	1 233 772	1911	1 951 255
1905	1 153 939	1912	1 813 463
		1913	1 896 017

Table XVI. — Estimated Production of Linseed Cake and Meal in the United States.

	metric tons		metric tons
1902	398 757	1908	412 836
1903	431 955	1909	391 389
1904	378 034	1910	367 990
1905	358 780	1911	417 982
1906	301 245	1912	542 985
1907	341 781	1913 (provisional)	425 716

Table XVII. — Production of Other Feeding Stuffs in the United States (data taken from the Census).

Products	1899	1904	1909
	metric tons	metric tons	metric tons
Feeding stuffs derived from cereals	4 563 736	—	5 444 34
	francs	francs	francs
Sugar-beet pulp (value)	113 093	1 074 228	4 524 75

TABLE XVIII. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN THE UNITED STATES.
(Fiscal year ending June 30).

Feeding stuffs	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914 (provisional)
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Imports.											
Barley	1 975	1 764	393	834	4 340	58	(a)	(a)	(a)	.....	(a)
Maize	422	392	257	275	516	6 555	(a)	(a)	1 357	22 934	314 141
Oats	2 480	563	329	1 082	5 288	96 771	15 016	1 558	38 064	10 507	323 447
Oil cakes	814	512	2 474	233	1 292	790	2 362	5 627	7 693	5 011	.....
Sugar-beet pulp	.....	.....	.....	.....	.....	706	1 545	1 218	(b)	(b)	.....
Exports.											
Barley	276 404	270 817	450 343	209 275	110 471	167 149	109 518	238 754	40 267	445 450	168 783
Bran	19 501	36 875	101 013	94 162	118 793	46 471	54 407	68 773	146 823	164 926	71 387
Maize	1 418 874	2 255 792	2 990 172	2 115 921	1 332 176	910 713	934 817	1 619 605	1 016 025	1 246 299	238 283
Maize meal	52 520	33 033	48 344	68 177	58 188	40 264	29 474	41 185	39 083	38 121	29 892
Distillery and brewery residues	56 937	76 761	104 331	85 938	66 736	76 715	66 548	78 035	74 810	80 430	60 747
Oats	16 746	79 532	672 306	58 264	16 817	21 922	24 464	29 682	31 519	490 014	26 997
Maize germ cake and meal	6 357	10 964	21 963	25 768	29 995	24 146	22 275	37 823	32 881	34 592	26 776
Cotton cake and meal	372 102	567 853	503 864	608 249	421 516	559 617	290 338	364 957	586 805	511 691	362 860
Linseed cake and meal	303 392	280 545	344 237	302 062	315 760	309 695	295 884	253 863	270 392	380 163	300 671

(a) Included in « Other » grain products. — (b) Included in « All other breadstuffs », fresh or dried.

Philippine Islands.

TABLE XIX. — EXPORTS OF COPRA (in metric tons).

Year..	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Amount	38 959	50 461	58 768	54 334	91 041	104 037	120 024	138 573	141 186	76 125

France.

The Office of Agricultural Intelligence, Ministry of Agriculture, has communicated the following data which are drawn from the Customs Returns.

TABLE XX. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN FRANCE.

Year	Brewers' grains	Olive pomace	Sugar-beet pulp	Oil cakes	Bran
	metric tons	metric tons	metric tons	metric tons	metric tons
			Imports.		
1904	3 357	2 714	11 193	132 456	164 696
1905	4 568	5 302	22 787	146 837	236 589
1906	25 528	2 120	47 769	107 831	215 290
1907	12 275	1 599	45 822	112 391	209 225
1908	8 815	3 279	32 193	90 845	148 737
1909	6 655	698	31 574	124 229	189 452
1910	42 500	512	68 214	131 811	174 940
1911	55 972	172	48 113	142 795	157 439
1912	42 743	2 401	42 938	154 968	171 688
1913 [1]	65 887	341	1 157	101 543	231 888
			Exports.		
1904	19 924	955	1 201	159 496	32 229
1905	24 576	205	561	154 008	16 423
1906	18 779	845	1 402	146 729	20 613
1907	23 788	564	1 193	141 673	24 950
1908	22 135	1 537	926	149 546	59 252
1909	22 200	237	1 003	186 129	44 017
1910	22 514	1 071	1 213	212 806	34 118
1911	31 324	178	1 138	222 764	33 245
1912	41 460	1 259	962	212 690	36 888
1913 [1]	26 463	507	154	214 801	35 478

(1) Provisional figures.

French Colonies.

TABLE XXI. — EXPORTS OF OIL SEEDS AND FRUITS FROM VARIOUS FRENCH COLONIES IN 1912.

Exporting colony	Groundnuts		Palm and karité kernels	Cotton and kapok seed	Sesame	Other oil seeds	Copra.
	undecorticated	decorticated					
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Senegal	184 762	.....	1 764	.....	.....	.....	.....
Upper Senegal and Niger	1 761	5 830	897	16	7	2	.....
French Guinea	2 020	.....	5 135	.....	411	58	.....
Ivory Coast	.....	.....	6 799	.....	.....	8	22
Dahomey and Dep.	.....	.....	37 296	170	.....	25	301
Gabun	.....	.....	359	.....	.....	.....	1
Madagascar	.....	.....	.....	.....	.....	243	.....
Mayotte and Dep.	34	.....	.....	.....	.....	1 320	.....
French Somali Coast	.....	.....	.....	.....	.....	1	.....
Indo-China	.....	405	42	2	894	755	7 982
French Establishments in India	213	9	.....	.....	.....	.....	.....
Guadeloupe and Dep.	.....	.....	.....	28	.....	.....	3
New Caledonia and Dep.	.....	.....	.....	378	.....	.....	2 856
French Establishments in Oceania	.....	.....	.....	74	.....	.....	6 113

United Kingdom.

In a Memorandum appended to the Report on the Agricultural Output of Great Britain which was made in connection with the Census of Production Act, 1906 [Cd. 6277], tables are given which summarise the data collected in connection with the production of feeding stuffs in Great Britain. Using these data together with statistics of imports and exports of the whole United Kingdom and of Ireland which were furnished by the commissioners of Customs and Excise and the Department of Agriculture and Technical Instruction for Ireland respectively and some more indirect information, it has been possible to estimate the amount of feeding stuffs available to British agriculturists in 1907. Owing to the fact that it was necessary for the détailed particulars of the production to be given for the whole United Kingdom in some instances, in order that the production of a few firms in Ireland might not be revealed, to the duplication of returns of production in certain instances where the product of one factory becomes the raw material of another, and also to the absence of exact published

statistics of importation and exportation to and from Great Britain apart from the United Kingdom, the results presented must be regarded as approximate.

Table XXII. — Production of Corn Offal and Feeding Meals in Great Britain (1907).

	Metric tons
Grain milling factories:	
Wheat offals	1 800 474
Oatmeal offals	21 083
Barley meal and flour	303 237
Bean meal and split beans	58 168
Maize meal and milled products of maize (other than offals)	442 130
Other sorts of meals (including oil cake meal)	113 136
Provender and feeding stuffs	84 484
Offals (other than wheat and oat offals)	11 384
	francs
Brewing and malting factories:	
Grains, malt coombings and other offals	24 817 858
Spirit distilling factories:	
Offals and other products	6 381 014

Table XXIII. — Net Exports of Corn Offal and Feeding Meals from Great Britain in 1907.

	Metric tons
Total imports into the United Kingdom	181 973
Deduct imports into Ireland from Great Britain and places abroad	108 869
Imports into Great Britain	73 104
Total exports from United Kingdom	264 018
Deduct exports from Ireland to Great Britain and places abroad	30 126
Total exports from Great Britain	233 892
Net exports » » »	160 788

Table XXIV. — Production of Oil Cakes in Great Britain (1907).

Oil cakes:	Output of firms giving particulars — metric tons	Estimated output of United Kingdom — metric tons
Cotton	492 783	530 377
Linseed	234 707	252 996
Rape	33 530	36 578
Others	58 931	62 995
Total	819 951	882 946

Table XXV. — Net Imports of Oil Cakes and Other Manufactured Feeding Stuffs into Great Britain (1907).

	metric tons
Total imports into United Kingdom	366 793
Deduct imports into Ireland from Great Britain and places abroad	68 075
Imports into Great Britain	298 718
Total exports from United Kingdom	66 043
Deduct exports from Ireland to Great Britain and places abroad	5 080
Total exports from Great Britain	60 963
Net imports into Great Britain	237 755

Table XXVI. — Consumption of Feeding Stuffs in Great Britain (1907).

	Total production	Net exports	Total consumption
	francs	francs	francs
Corn offals and feeding meals	411 640 000	19 850 000	391 790 000

	Total production	Net imports	Total consumption
	francs	francs	francs
Oil cakes and other manufactured feeding stuffs	151 330 000	37 500 000	188 830 000
	562 970 000	17 650 000	580 620 000

Table XXVII. — Production of Feeding Stuffs in Ireland (1907).

	metric tons
Grain milling factories:	
Wheat offals	124 973
Oatmeal offals and by-products	14 783
Barley meal and flour	4 877
Bean meal and split beans	4 013
Maize meal and milled products of maize (other than offals)	467 886
Other meals	14 275
Provender and feeding stuffs	2 997
Offals other than wheat and oat offals	1 219
	francs
Brewing and malting factories:	
Grains, malt combings and other offals	2 315 240
Spirit distilling factories:	
Offals and other waste products	2 748 980

TABLE XXVIII. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN IRELAND (1907-1913).

Feeding stuffs	1907	1908	1909	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Imports							
Maize	769 499	555 908	636 420	580 956	605 935	690 000	755 944
Linseed cake	25 615	27 635	27 899	25 753	20 974	22 470	28 378
Cotton cake	12 068	16 993	21 927	15 767	18 904	22 916	20 808
Oil cake, unclassified.	13 227	10 339	12 664	13 009	11 958	14 431	19 271
Maize meal	3 582	2 465	2 760	2 646	2 766	1 605	1 879
Linseed meal	1 295	1 598	1 917	1 887	2 390	1 577	1 579
Cottonseed meal	5 531	8 639	11 647	10 321	10 564	15 858	13 661
Bran and pollards	69 167	61 419	48 114	59 985	61 205	69 108	59 108
Other grain offal	6 327	3 342	3 221	2 638	3 029	3 386	2 155
Brewers' and distillers' grains	5 976	4 338	4 993	2 407	3 094	4 091	4 345
Feeding meals, unclassified	20 096	17 603	21 781	20 106	22 354	26 048	28 851
Feeding stuffs, unclassified	10 375	8 674	10 850	12 216	9 640	13 754	7 431
Exports							
Maize	34 743	43 937	40 970	33 797	22 871	34 664	40 655
Oil cakes	1 659	2 349	2 467	846	1 735	2 164	1 609
Maize meal	1 767	2 140	2 193	1 387	1 737	2 420	2 691
Cottonseed meal	403	174	1 731	352	667	1 768	369
Bran and pollards	1 502	461	5 151	2 147	2 548	1 996	2 553
Other grain offal	10 043	10 381	11 262	12 517	19 078	17 220	13 524
Brewers' and distillers' grains	13 801	11 166	8 655	9 219	8 130	5 232	5 704
Feeding meals, unclassified	2 665	3 922	2 825	4 393	4 500	5 948	5 814
Feeding stuffs, unclassified	1 325	440	372	394	871	650	455

Australia.

The data given in Table XXIX were supplied by the Department of External Affairs, Commonwealth of Australia.

TABLE XXIX. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN AUSTRALIA (1908-1913).

Feeding stuffs	1908	1909	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Exports.						
Oil cakes	367	720	1 015	693	458	146
Bran, pollard and sharps	3 389	5 746	6 749	9 767	6 706	12 222
Malt, including granulated maize and rice malts	10	9	5	1	2	2
Rice meal and flour	1 222	202	2 357	2 788	1 461	288
Beans and peas	362	18	12	10	8	7
Split peas	48	2 022	2 072	2 579	2 233	2 160
Compressed fodder	3 629	6 867	12 545	13 239	6 521	8 096
Barley	138	524	54	0,3	1	29
Maize meal and « maizena »	15	7	8	5	6	6
Oatmeal, wheat meal and rolled oats	240	321	454	192	60	308
Imports.						
Oil cakes	70	52	148	57	40	32
Bran, pollard and sharps	802	1 329	811	3	2 048	424
Malt, including granulated maize and rice malts	3 826	2 006	1 963	1 864	2 337	1 542
Rice meal and flour	31	16	8	16	22	13
Beans and peas	876	702	731	1 059	1 414	1 380
Split peas	15	24	19	11	15	4
Barley	4	2	2	7	4	4
Maize meal and « maizena »	341	250	211	204	199	210
Oatmeal, wheat meal aud rolled oats	373	324	362	265	344	365

British India.

The Department of Revenue and Agriculture (India) has communicated the following information :

The chief concentrated cattle foods used in India are :

1. Cotton seed.
2. Oil cakes - sesamum, linseed, safflower and coconut.
3. Grains - oats, barley and maize.
4. Pulse, gram, kulthi (*Dolichos biflorus*), guar (*Cyamopsis psoraloides*) and lang (*Lathyrus sativus*).

5. Husks (bhusa) of various grains and pulses, as well as wheat bran and other by-products (chuni) got in the preparation of pulses.

Cotton seed is used in cotton-producing districts for milch cattle and buffaloes. No statistics of production or consumption are available.

Sesamum, rape and linseed cakes are the important oil cakes used generally. Statistics of production and consumption are not available, but some idea can be formed from the production and export of oil seeds. On an average, during the last five years, 481 240 long tons of sesamum seed have been produced annually in India ; of this 113 410 long tons are exported, leaving 367 830 tons which are pressed in India and which may be supposed to yield roughly 250 000 long tons of cake. A small quantity of the cake is exported and the rest is consumed in the country. In the same way the production of linseed cake comes to roughly 125 000 long tons, out of which some quantity is exported, but statistics are not available.

Cereal grains are mostly used by Europeans and on Government Farms, as cultivators cannot afford to use them generally as cattle food. There are no statistics.

Pulses, etc., are used to some extent by well-to-do cultivators, but no statistics are available.

Husks are produced in cultivators' own homesteads and are used by them sometimes for milch cattle and hard-worked animals when available.

TABLE XXX. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN BRITISH INDIA.

Feeding stuffs	Exports		Imports	
	1912-13	1913-14	1912-13	1913-14
	metric tons	metric tons	metric tons	metric tons
Fodder, bran and pollards:				
Bran and pollards	232 645	225 556	—	—
Other	11 610	7 826	—	—
Total	244 255	233 382	3 153	3 874
Oil cakes:				
Castor	7 121	4 981	—	—
Coconut	6 506	4 276	—	—
Cotton	7 118	10 596	—	—
Groundnut	63 397	63 022	—	—
Linseed, rape, sesamum	73 154	90 924	—	—
Others	7 083	4 327	—	—
Total	164 379	178 126	19	86

TABLE XXXI. — EXPORTS OF OIL SEEDS AND FRUITS FROM BRITISH INDIA.

Oil seeds and fruits	1911	1912	1913
	metric tons	metric tons	metric tons
Linseed	522 000	354 000	414 000
Groundnut	191 000	243 000	278 000
Rape	235 000	218 000	249 000
Sesame	95 000	78 000	112 000
Cotton	203 000	130 000	284 000
Copra	31 000	34 000	38 000
Bassia	40 000	13 000	33 000
Poppy	35 000	23 000	19 000
Total oil seeds and fruits	1 352 000	1 093 000	1 427 000
yielding cake	676 000	546 500	713 000

Mauritius.

A communication from the Colonial Secretary's Office, Mauritius, gives the following particulars with regard to feeding stuffs in the Colony: The manufacture of feeding stuffs is a recent undertaking and is carried out only on a small scale. The sugar estates in the Colony, where mechanical traction is not employed, use oxen for motive power and feed them upon raw products with occasional small quantities of concentrated feeding stuffs. Molascuit (1) is made at some sugar factories and the greater part is exported. Groundnut cake is available from the oil factory, where local and imported groundnuts are crushed; some 25 long tons of cake were made in 1913 and commanded a ready sale at £ 11 to £ 13 per ton; during 1914, it is estimated that between 60 and 70 tons of the cake will be manufactured.

Experiments have also been made in the crushing of oil seeds, and further trials are anticipated. In the Oil Islands, dependencies of the Colony of Mauritius, a thriving coconut industry exists; oil is extracted in the Islands and some coconut meal (poonac) is sent to the Colony, but accurate details as to quantities are not available, as in the Customs returns copra and poonac are classed together; the quantities vary, but are never considerable.

TABLE XXXII. — EXPORTS OF MOLASCUIT FROM MAURITIUS (1904-1913).

Year	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Exports of molascuit, in metric tons	65.4	97.5	332	145	354	385	121	11.8	376	434

(1) Exhausted cane molasses mixed with the interior pith of the cane plant.

Union of South Africa.

The Department of Agriculture, Union of South Africa, furnished the data set out in Table XXXIIII.

TABLE XXXIII. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN THE UNION OF SOUTH AFRICA (1909-1913).

Feeding stuffs	Imports					Exports				
	1909	1910	1911	1912	1913	1909	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Oil cake (coconut and palm kernel)	.....	.....	.....	.....	.....	84	14	126	2 136	2 810
Bran	518	77	15	17	1 395	207	277	462	335	166
Maize	1 502	25	29	606	15 404	138 593	161 616	93 691	87 441	11 519
Maize meal	12	1	8	12	304	840	1 177	1 186	4 968	2 131
Samp	201	33	41	9	362	.....	.....	61	94	203
Others, molassine meal, mola-scuit, poultry food	579	882	572	347	629	2 996	10 250	5 649	5 741	3 429

Other British Colonies.

TABLE XXXIV. — EXPORTS OF COPRA AND PALM KERNELS FROM BRITISH POSSESSIONS.

	Year	Copra	Palm kernels
		metric tons	metric tons
Ceylon	1913	56 761	—
Straits Settlements	*id.*	9 437	—
Seychelles	*id.*	2 984	—
Tonga Islands	1912	11 400	—
Fiji Islands	1913	8 056	—
Territory of Papua	1912-13	807	—
Solomon Islands	*id.*	4 263	—
Gilbert nd Ellica Islands	1911	2 118	—
British East Africa	1912-13	1 589	-
Zanzibar	1913	7 531	—
Gold Coast	1913; 1912	640	14 864
Nigeria	*id.*	98	187 587
Sierra Leone	1912	—	51 565
Gambia	1912	—	452
Trinidad	1913	524	—
British Guiana	1912-13	58	—
Others	1912	47	—

Italy.

The data in Table XXXV were obtained from the Customs returns.

TABLE XXXV. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN ITALY.

Feeding stuffs	Imports			Exports		
	1912	1913	1914	1912	1913	1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Bran	9 187	10 618	4 287	28 115	31 823	37 275
Pollards (re-exported)	.....	.....	.....	22 627	27 336	25 492
Oil seeds and fruits:						
Linseed	42 880	45 429	32 374	11	46	11
Rape	3 209	10 183	21 980	.....	.....	4
Sesame and groundnut	25 358	24 774	28 863	27	16	26
Palm	254	110	343	.....	.....	.....
Others	1 685	1 040	1 433	1 129	1 283	423
Total oil seeds and fruits	73 386	81 536	84 993	1 167	1 345	464
yielding cake	36 693	40 768	42 496	583	672	232
Oil cakes	3 913	2 957	1 121	26 194	19 662	54 693
Olive pomace	.....	.....	13 411	.....	.....	803
Hay	*2 813*	*7 527*	*6 558*	*61 365*	*63 678*	*47 668*

Japan.

According to the Bureau of Agriculture of the Imperial Ministry of Agriculture and Commerce, the imports of bran into Japan were 28 184 and 39 558 metric tons in 1912 and 1913 respectively.

Norway.

TABLE XXXVI. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN NORWAY.

	Imports		Exports	
	1912.	1913.	1912.	1913.
	metric tons	metric tons	metric tons	metric tons
Meal:				
Barley	1 895	1 576	.....	.....
Oatmeal	3 633	4 659	.....	.....
Rice	2 158	2 442	.....	.....
Bran:				
Wheat	.....	.....	21 256	14 806
Rice	2 766	1 509	.....	.....
Oil seeds and fruits:				
Copra	3 960	4 405	.....	.....
Linseed	10 034	14 705	.....	.....
Rape	256	964	.....	.....
Total oil seeds and fruits	14 250	20 074	.....	.....
yielding cake	7 625	10 037	.....	.....
Linseed and othe cakes	29 665	30 173	342	3 485
Molasses	5 958	6 723	.....	.....
Fish meal (herrings, whales, etc.)	.....	.....	14 548	8 928
Hay	.....	.....	*3 831*	*12 133*
Straw	.....	.....	*709*	*1 142*

Netherlands.

The Ministry of Agriculture of the Netherlands has communicated the data set out in Tables XXXVII-XXXIX.

TABLE XXXVII. — AMOUNTS OF FEEDING STUFFS BOUGHT BY COOPERATIVE SOCIETIES IN THE NETHERLANDS (1910).

Feeding stuffs	metric tons	Feeding stuffs	metric tons
Linseed cake	37 771	Buckwheat, grain and meal	199
Linseed meal	12 937	Rice and rice meal	4 575
Rape cake and meal	2 651	Maize germ cake and maize meal	32 784
Sesame cake and meal	83	Bran, pollards and other grain offal	2 297
Molasses	177	Seeds of corn-cockle and other weeds	267
Palm cake	17	Peas and pea meal	5 139
Cottonseed meal	1 313	Beans and bean meal	435
Soya cake and meal	2 313	Dried brewers' grain	98
Wheat and wheat meal	837	Pulp of various kinds	808
Rye and rye meal	13 615	Other feeding stuffs	4 332
Barley and barley meal	13 210		
Oats and oatmeal	7 865		

TABLE XXXVIII. - IMPORTS OF FEEDING STUFFS INTO THE NETHERLANDS.

Feeding stuffs	Unit	Imports in :									
		1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Wheat	1000 hl. (*a*)	18 329	22 496	16 139	19 488	14 573	21 673	25 774	21 254	23 873	28 821
Rye	*Id.*	7 166	7 009	7 195	5 861	5 202	6 366	8 043	9 555	7 434	8 739
Barley	*Id.*	8 698	9 037	1 009	9 132	10 727	11 838	13 611	15 026	11 157	14 850
Oats	*Id.*	6 463	13 826	8 402	6 080	6 595	9 537	10 543	11 261	16 189	12 539
Buckwheat	*Id.*	147	177	200	218	242	298	272	299	345	275
Maize	1000 kg.	420 318	412 383	642 783	741 516	641 669	582 055	546 426	653 910	971 913	1 006 875
Pollards	*Id.*	11 238	18 435	8 064	11 981	13 944	11 478	12 010	18 193	16 509	20 449
Bran	*Id.*	17 340	17 893	25 513	23 988	22 573	22 941	34 491	90 645	40 646	.....
Wheat, rye and buckwheat meal	*Id.*	213 134	210 104	257 228	208 847	247 653	248 831	269 060	289 029	281 621	.....
Beans and vetches	1000 hl. (*b*)	321	220	283	338	341	497	493	589	519	.....
Peas	*Id.*	824	990	666	534	549	923	1 216	1 526	1 770	.....
Rape and other oil seeds	*Id.*	615	1 222	1 573	333	1 180	1 238	2 516	1 772	1 984	.....
Linseed	*Id.*	4 015	3 565	3 373	3 710	4 337	3 636	2 816	2 517	3 072	4 027
Linseed cake and meal	1000 kg.	.....	186 720	215 286	240 401	263 434	239 759	241 283	198 337	261 099	275 122
Rape *id.*	*Id.*	.....	4 518	4 347	4 832	5 294	3 887	4 984	9 184	7 629	4 685
Sesame *id.*	*Id.*	.....	402	390	546	908	1 765	3 434	3 190	4 439	1 719
Cotton *id.*	*Id.*	.....	34 212	28 746	31 431	36 131	27 333	30 908	26 236	35 650	25 276
Other *id.*	*Id.*	.....	5 912	7 102	13 077	12 285	11 912	25 849	54 786	64 383	40 879

(*a*) 1 hectol. of wheat = 75 kg.; 1 hectol. of rye = 72 kg.; 1 hectol. of barley = 60 kg.; 1 hectol. of oats = 46 kg.; 1 hectol. of buckwheat = 70 kg.
(*b*) 1 hectol. of beans and vetches = 78 kg.; 1 hectol. of peas = 80 kg.; 1 hectol. of rape = 68 kg.; 1 hectol. of linseed = 68 kg.

TABLE XXXIV. — EXPORTS OF FEEDING STUFFS FROM THE NETHERLANDS.

Article	Unit	Exports in:									
		1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Wheat	1000 hl. (*a*)	14 762	19 251	12 007	16 227	10 855	17 226	21 156	16 754	18 668	23 078
Rye	*Id.*	3 648	3 730	4 232	3 767	2 920	3 738	4 605	5 431	3 856	5 074
Barley	*Id.*	5 029	5 800	6 799	7 228	7 530	8 112	9 482	11 262	8 693	11 343
Oats	*Id.*	5 800	11 627	6 902	5 608	5 527	7 332	8 520	9 149	13 037	9 024
Buckwheat	*Id.*	66	119	39	86	63	98	89	103	79	90
Maize	1000 kg.	113 010	108 679	152 666	208 694	176 729	185 656	129 574	150 866	344 370	300 183
Pollards	*Id.*	5 675	5 784	7 815	8 007	8 223	10 013	9 223	9 767	12 956	.....
Bran	*Id.*	45 284	47 471	52 504	58 890	51 831	51 043	59 012	56 303	66 575	.....
Wheat, rye and buckwheat meal	*Id.*	45 850	46 389	47 902	43 570	48 507	72 355	77 156	84 023	95 532	.....
Beans and vetches	1000 hl. (*b*)	315	322	280	297	311	339	328	401	336	.....
Peas	*Id.*	573	521	495	520	517	639	665	814	607	.....
Rape and other oil seeds	*Id.*	304	759	491	140	740	766	1 497	1 219	1 179	.....
Linseed	*Id.*	1 927	1 302	1 231	1 284	1 619	1 136	703	632	849	1 270
Linseed cake and meal	1000 kg.	.....	28 216	29 670	52 624	30 497	35 557	56 288	33 343	44 365	43 955
Rape *id.*	*Id.*	.....	2 178	1 232	1 585	1 660	3 468	9 018	14 401	10 913	10 345
Sesame *id.*	*Id.*	.....	7 212	4 521	5 675	4 564	8 584	12 775	10 067	9 529	11 380
Cotton *id.*	*Id.*	.....	24 352	24 553	25 407	28 589	18 577	22 798	20 407	25 240	18 568
Other *id.*	*Id.*	.....	4 704	6 984	8 300	5 868	5 828	11 562	17 471	24 714	19 395

(*a*) 1 hectol. of wheat = 75 kg. ; 1 hectol. of rye = 72 kg. ; 1 hectol. of barley = 60 kg. ; 1 hectol. of oats = 46 kg. ; 1 hectol. of buckwheat = 70 kg.
(*b*) 1 hectol. of beans and vetches = 78 kg. ; 1 hectol. of peas = 80 kg. ; 1 hectol. of rape = 68 kg. ; 1 hectol. of linseed = 68 kg.

Dutch East Indies.

The data given in Tables XXXIX and XL were communicated by the Department of Agriculture, Industry and Commerce for the Dutch East Indies.

Table XXXIX. — Exports of Feeding Stuffs from the Dutch East Indies.

Feeding stuffs	1912 (Jan.-June)	1913 (Jan.-June)	1914 (Jan.-June)
	metric tons	metric tons	metric tons
Copra	35 988	36 061	28 010
Grundnuts	8 611	6 330	7 137
Manioc roots and tapioca residues	11 230	12 853	8 283
Molasses	48 720	55 050	52 957

Table XL. — Exports of Copra from the Dutch East Indies (1904-1913).

Place of export	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Java	29 716	107 709	52 000	69 666	94 740	68 217	100 578	91 022	84 650	78 800
Makassar	9 125	25 961	9 641	17 248	21 519	19 256	30 880	38 964	37 822	29 570
Sangir, Menado, Gorontalo	11 746	19 514	14 481	16 080	24 047	20 706	27 298	33 914	30 076	26 648
Padang	6 120	6 580	6 638	8 694	11 927	9 390	10 479	14 383	17 351	17 617

Russia.

The data in Tables XLI-XLIII are drawn from the agricultural year-book (1914) published by the Office of Land Organisation and Agriculture (Rural Economics and Agricultural Statistics Division).

TABLE XLI. — EXPORTS OF OIL SEEDS FROM RUSSIA.

Oil seeds	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Linseed	101 215	95 842	70 764	108 553	119 856	86 096	153 698	98 610	146 884	161 036
Hemp	17 822	15 643	10 713	18 805	25 210	22 343	20 066	8 878	21 164	10 762
Poppy, sesame and others	21 728	14 581	15 967	11 683	14 453	18 391	28 508	24 508	23 097	52 337
Rape	31 802	60 661	59 425	21 151	18 069	21 914	30 021	7 626	15 506	25 578
Total oil seeds...	172 567	186 727	156 869	160 192	177 588	148 744	232 293	139 622	206 651	249 713
yielding cake...	86 284	93 442	78 438	80 092	88 839	74 367	115 990	69 813	103 328	125 858

TABLE XLII. — EXPORTS OF OIL CAKES FROM RUSSIA.

Oil cakes	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Linseed cake	118 971	120 984	149 409	167 681	193 652	176 331	207 417	195 240	210 221	149 239
Hemp »	48 352	43 998	58 930	40 372	62 038	45 426	37 823	42 640	48 248	70 083
Sunflower »	130 275	202 634	139 337	128 332	175 945	193 283	278 134	219 045	158 908	246 190
Rape »	34 409	46 799	71 275	42 339	35 842	19 409	21 654	24 908	29 421	35 914
Other »	53 589	52 103	72 891	64 606	56 815	93 587	117 242	141 159	128 881	157 521
Total...	385 596	466 518	491 842	443 330	524 292	528 036	662 270	622 992	575 679	658 947

TABLE XLIII. — EXPORTS OF BRAN FROM RUSSIA.

Year	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Exports, in metric tons	489 596	595 888	622 720	582 571	647 405	589 500	520 473	638 920	617 993	803 363

Sweden.

TABLE XLIV. — PRODUCTION OF FEEDING STUFFS IN SWEDEN.

Feeding stuffs	1910	1911	1912
	metric tons	metric tons	metric tons
Meal:			
Oatmeal	15 085	14 860	23 366
Wheat	111	106	112
Barley	4 019	3 919	3 526
Rice	10 638	10 469	13 093
Other	8	.....	3
Pollards	19 810	23 023	24 470
Bran	126 029	128 414	132 456
Oil cakes and linseed	19 589	23 051	27 695

Table XLV. — Imports and Exports of Feeding Stuffs in Sweden (1913).

Feeding stuffs	Imports	Exports
	metric tons	metric tons
Meal:		
Oatmeal	327	4 685
Wheat	1 440	.....
Barley	3	.....
Rice	1 539	.....
Other	91	.....
Bran:		
Oat	1	18 913
Wheat	55 780	1 250
Rice	4 907	315
Rye	2 287	5 251
Other	173	.....
Oil seeds:		
Linseed	28 876	.....
Rape	914	.....
Total oil seeds	29 790	.....
yielding cake	14 895	.....
Oil cakes:		
Cotton	9 485	1 704
Hemp	435	.....
Groundnut	86 887	61
Linseed	4 359	224
Rape	12 694	.....
Soya	7 937	5
Sunflower	37 040	75
Others	421	.....
Other foods:		
Gluten	6 652	.....
Molasses	4 980	.....
Maize (in various forms)	7 116	5
Others	6 499	58
Compressed maize meal	15	.....
Hay	*400*	*12 993*
Straw	*11*	*3 967*

Straw is almost exclusively used as a feeding stuff in Sweden, as all litter requirements are supplied by the abundant peat moss.

Switzerland.

The data given in Table XLVI are drawn from the commercial statistics for Switzerland.

TABLE XLVI. — IMPORTS AND EXPORTS OF FEEDING STUFFS IN SWITZERLAND.

Feeding stuffs	Imports		Exports	
	1912	1913	1912	1913
	metric tons	metric tons	metric tons	metric tons
Oil seeds and fruits	1 949	2 129	11	8
yielding cake	974	1 064	5	4
Oil cakes and oil seed meals	34 091	24 928	956	1 015
Malt germs, brewers' grains, etc.	5 513	6 153	3 954	4 194
Bran	14 908	10 151	14 304	17 057
Feeding meals	53 543	57 937	83	69
Milling offals	5 842	6 730	864	1 005
Hay	*690 584*	*499 376*	*956*	*1 015*

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FIRST PART.

ORIGINAL ARTICLES

Geo-Hydrological Studies and Research in Italy in Connection with Agriculture

by

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In Italy, as elsewhere, geo-hydrological studies and research, taken in a general sense, date far back, but the investigations dealt almost exclusively with the seeking of good drinking water for inhabited centres. In the remotest times also gigantic hydraulic works were built for the control of superficial waters, with the object of keeping them off the land when they were in excess, or of leading them to it when required. All these colossal works, of which the Romans were justly proud, both for their conception and for their importance, show that from ancient times technical ability in hydraulics flourished in Italy and that agriculture was always held in high esteem. But positive and concrete ideas of geo-hydrological nature do not appear in geological works except in very recent times. We are indebted to SAVI for a work of the kind on the plain of Pisa (*Studi geologico-agricoli sulla pianura pisana*, 1856). Unfortunately in Italy also, the applications of geology in general and those concerning water do not occupy at present the position they ought to have considering the useful results which they yield. Nevertheless, among Italian geologists there are not wanting those who, convinced of the practical importance of their science, devoted their knowledge and their activity to geo-hydrological research, gathering a rich harvest, fruitful of results which deserve to be mentioned, be it even briefly.

Intensive agriculture cannot be practised in districts not provided with drinking water. Unfortunately in our country people are very unwilling to resort to cisterns for their water supply, notwithstanding the

fact that when these are properly built and kept they can provide most wholesome water. It is for this reason that the search for springs and subterreanean water tables, both superficial and deep, is always becoming more active. Thus geological and especially spelaeological investigations have finally, in Italy also, made a distinction between the water which circulates in highly permeable rocks and soils and that which traverses the whole finely porous mass. The different hygienic value of water arising under various geological conditions appeared thus evident. For the waters of open soils the geological deductions on springs and on their reappearance were positively demonstrated by the use of colouring matters, and for the others decisive experiments were made which rendered evident the intimate connection in chemical composition between the permeable rocks and the percolating water. This absorption, which modifies the water medium diffused according to the lithological nature of the rocks, attributes now a common origin to waters that were considered distinct from each other.

The phreatic waters which supply so many wells of our larger valleys also attracted the attention of geologists, who, together with chemists and hygienists, define exactly the copious reserves of a phreatic nature and point out their suspicious quality on account of their easy contamination.

The investigations were not limited to the free water-tables, but they were also profitably extended to those under pressure, for which the necessary conditions of success were formulated (stratigraphical, tectonic and hydraulic conditions), determining with exactitude the field of geological investigation in order to recognize the soundness of the deductions. The geologist, in fact, can hardly ever affirm absolutely that a boring will be successful; he can, however, sometimes assert the impossibility of success.

The origin of the water, its course among the rocks of the subterranean basin (which is often different from the hydrographical basin) and the manner of its cropping out being known, the fundamental rules for capturing the springs and subterranean water-tables can be safely dictated with detail, with the object of attaining the three desiderata: the highest level of outcrop, the maximum yield, the impossibility of pollution. This result is so important that it has been attempted to introduce it in the legislation in Italy, as has already been done in other countries possessing a high tradition of hydraulic science.

Another merit of geologists has been their examination of the results of chemical analysis. By the light of geological data, water which was declared unfit for drinking purposes on account of its excessive content of foreign matter or because this was considered injurious according to the rules laid down by the Commissions of Hygiene, was recognised as harmless and suitable for drinking purposes. Thus I caused a phreatic water considered undrinkable through excess of chlorine and organic matter and the presence of nitrites, to be recognised as wholesome by showing that the chlorine came from salt-water bearing sands, that the organic matter was

taken up by passing through strata of fossil wood, and that the nitrites originated in minerals, thus removing all suspicion from the salts.

Geo-hydrological study claims another important conquest. The outcrop of springs was guarded against pollution by a protective belt which hitherto was determined by prudential reasons and considerations of vicinity. Now it has been proved that the protective belt round the outcrop is sometimes almost useless, especially if it extends lower down than the basin which collects the water, whilst on the other hand it has been recognized necessary to protect the spring at distant points at which contamination can easily reach the water-table. Karstic regions offer typical examples of the kind. Moreover, by considering the direction of the movement of the water film, the capacity for water of the permeable stratum, the height of the water-table and its yield, the position, form and area of the belt of certain protection can be determined.

The possibility of irrigation, its opportuneness, the intake and distributing structures, the quantity required by different soils (relatively to their mechanical and chemical composition), are questions that geology applied to agriculture poses and solves.

Circulating liquids have also been the subject of much investigation, with the object of discovering the hidden phenomena which take place between the complex, multiform fluid which circulates in the soil and vegetation. The agricultural soil is no longer investigated in its static condition, but from the dynamic point of view, namely the phases of evolution through which it passes in its formation from the parent rock.

The constructor of artificial reservoirs must avail himself of many different data furnished by applied geology. The tectonic conditions and lithological nature of the catchment basin and of the site of the reservoir, the floods of the intercepted watercourse, the rainfall in the different branches, especially in regard to the contemporaneous arrival of the floods, etc., are indispensable data which cannot be obtained without the geological study of the region. Geology again is necessary for the exact valuation of the permeability of the collecting valley. In fixing a coefficient of permeability in the empirical formulae for the flow of a watercourse, even when one believes he has used the greatest care, errors may be committed which will endanger the success of costly works.

It is fortunate for Italian farming that the Government gives a powerful stimulus to these great works for irrigation. The studious also contribute to investigations on the evolution of large barrages for artificial lakes, on the utility and the construction of smaller reservoirs and the like.

Besides, by means of the hygrolysimeter, the capillary ascending column can be recognized and measured quantitatively according to the soil, during the dry weather, as well as the interruption of capillarity due to surface tillage which breaks up the cohesion of the soil.

Of the reclamation of swampy lands, also, Italy can show some fine and ancient examples. It is true that drainage works are generally a technical problem to which geology is often foreign; but in some cases the solution cannot be found without the assistance of geology.

More than once, all the costly atempts at draining a swampy land have failed. Only geo-hydrological investigations can find the subterranean water film that waterlogs the land and suggest the means of cutting it down to the impermeable layer and preventing its ever returning to the reclaimed land.

This, as I have shown, happens not only at low levels but on high plateaus and on steep slopes. The rules that have been established will be very useful in future in the extensive swampy lands along the coasts, and those following the lower reaches of our largest rivers.

Drainage also, so exactly described by COLUMELLA and mentioned by PALLADIUS, must also be carried out according to the teachings of geology if it is to attain the desired effect with the least outlay. A knowledge of the subsoil, of the absorbent capacity of the rocks, of their specific capillarity, etc., must be the basis of any scheme of the kind.

The geologist also must be consulted as to the possibility of success of works intended to reclaim too humid soils. The conditions which can render an absorbent well advisable cannot be recognized without the geological investigation of the locality. Lands which are waterlogged through water held up by an almost superficial and irregular stratum can be reclaimed only with the assistance of geology.

The possibility of warping can be ascertained only by a study of the rocks of the basin and by a complete examination of the silt-conveying floods.

In Italy, of late years, important geo-hydrological work has been accomplished, of which we may be proud, but a good deal remains to be done, especially in connection with the districts least favoured by rain.

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The Control of Locusts in Italy

by

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The regions of Italy in which locusts appear with a certain frequency are: Sicily, Sardinia, Calabria, Basilicata, Apulia and Latium. They occur also, though much less frequently, in Tuscany and Venetia and the districts of Crema and Lodi.

These outbreaks are not, as is commonly believed, *invasions* from Africa but are due to locusts that are hatched and multiply, unnoticed for several years, in Italy itself and especially where the uncultivated lands used for grazing are interrupted here and there by arable land under grain and pulse crops, and where the land is allowed to lie fallow for a length of time and then ploughed up for two consecutive grain crops.

Our locusts sometimes migrate (if assisted by the wind to distances of 6 to 12 and even 20 miles) and therefore, occasionally, the term *invasion* is correct; usually, however, they are cases of *spreading* — due to the natural increase of the swarms and to their keeping together — which extend over tens of thousands of acres.

The bulk of the swarms of locusts in Italy always consists of *Stauronotus maroccanus* Thumb., while the Italian locust (*Caloptenus italicus* Linn.) is ordinarily represented by only a small proportion. Together with these two Acridiids, but only in Southern Italy, a Locustid, *Decticus albifrons* Serv., is more or less frequently found.

Many assert, and others simply repeat, that the locust invasions in Italy last two or three years and then disappear by themselves. I must on the contrary, state that our locusts may continue to multiply for many years without difficulty and that their almost total disappearance, if it is not due to the action of man, cannot occur except through the agency of the well-known fungus *Entomophthora* (= *Empusa*) *grylli*.

It is to this fungus that Prof. Gius. Cuboni, Director of the Royal Station of Plant Pathology in Rome (who attempted to spread it artificially), attributed the cessation of the severe attack in the Roman Campagna in the year 1888 and of the successive one in 1894 (1). This beneficial disease of locusts is much less frequent if not very rare in the southern provinces, perhaps owing to the almost constant spring and summer drought. It is a fact that neither I nor my collaborators in three successive campaigns against locusts in Sicily have ever found one case of mycosis.

There also locusts have certain true and valuable parasites, while various animals feed upon them; but in this practical paper we can only mention them briefly (see page 530).

(1) *Le cavallette, loro vita, danni e modi per prevenirli*: summary of a lecture, 1888.

Up to June 1911 the Italian Ministry of Agriculture granted subvens to the communes and provinces ravaged by locusts, but left the local thorities to control the pest as they thought best. The law of June 15, 11 (No. 529), however, rendered the control of locusts obligatory, and ovided for half of the expense to be defrayed by the State and half by e Provinces and Communes invaded or threatened.

It was in consequence of this law that the Ministry of Agriculture took rect part in the control of the pest, in order to render the work technicy and economically better, more practical and uniform, and in March 1912 was sent to Sicily to direct operations.

In 1911 the control of locusts was conducted in five provinces in Sicily, t the infestation was severe only in two, Palermo and Caltanisetta; it as slight in the province of Girgenti and still less important in the provces of Messina and Trapani.

In the above provinces every Commissioner acted according to his vn judgment; only sheet traps were used, except that here and there, here stubble and brush existed, fire was used to a limited extent.

The capture of locusts by means of sheets, though not always systemically carried out, had given tangible results in 1911, but more apparent an real, partly because it had been begun too late. Many sown crops were estroyed that year, especially in the Madonie district, and the locusts rtly extended the infested areas and partly migrated into the province Catania, perhaps also because they were disturbed at the time of eggying.

Convinced that with the use of sheets it was impossible to destroy or ntrol such serious and extensive infestations as those found in the Madonie d in the territory about Etna, I began to seek other more efficient, if t more economical, means of control; after three years' experimenting a large scale I think it may be said that the present system is practical d meets all requirements. I shall not describe the various phases of provement, but shall limit myself to a description of the methods in e at present in Italy for the control of locusts, mentioning the work complished last year and the results obtained.

In order to destroy the locust infestations it is necessary to discover em in time and to attack them when the task is easiest, when they are ore sensitive and slow in their movements, and lastly when they are ill in the egg stage.

The first thing to recommend is a vigilant service of exploration at e time the eggs hatch out, which in Italy ranges from the second half March to the beginning of June, according to altitude, aspect and nature the soil in which the eggs are deposited.

During the first days of their life, locusts live united on small spaces and en it is easy and economical to destroy them. Later, when they are in e last larval and in the nymph stages, they scatter during the day over considerable distance and collect again in other localities in the evening. he winged locusts are still more mobile, less gregarious and can more easily cape the attacks of man. Their resistance to the action of fire and of

chemicals grows with their age. Hence the necessity of discovering and destroying them as early as possible; besides, the sooner they are discovered the more time is available for their complete and economical destruction.

If the system of using arsenites of soda and lead to poison the grass be set aside, on account of the danger to human beings and of the possible risk of losing grazing animals or game, the only remaining efficient means of controlling locusts are the following :

1. The use of flames of burning petroleum mixed with benzine.
2. Sprayinng the locusts with contact washes.
3. Capturing them with sheets and collectors.
4. Collection and destruction of the egg-masses.

Where petroleum is cheap or where the infections are numerous, severe and threatening in the vicinity of sown fields and where it is not possible to have betimes sufficient quantities of the insecticide washes, of which more hereafter, the petroleum flame should always be adopted.

When the locusts are gathered together, as is their custom, in large masses, the flames destroy millions of them in a few minutes, without any preliminary work being required ; whilst when they are scattered, because they are older or feeding, they must be concentrated before being subjected to the flames.

For this purposes squads of 10 to 16 women and boys are to be posted in a curved line beyond the area occupied by the locusts. This line is gradually drawn in as the hedge, wall, ditch, depression or gully settled upon beforehand for the concentration of the locusts is neared. If there is no available spot, then the beaters take up positions in a circle, which gradually becomes smaller. They must carry in each hand a bundle of long grass (ferns, asphodels, etc., will do) or still better of twigs. At first they must stand about 10 or 13 feet apart and move to the right and left for about 6 feet while slowly advancing, sweeping their bundles of twigs to and fro over the ground. In this way the locusts are obliged to gather at the spot marked by the foreman, upon whose ability the success of the operation depends.

When the locusts have arrived at the obstacle or point determined upon and the beaters are close to each other, other workmen entrusted with the sprayers come up and at the word of command the beaters withdraw rapidly to the right or left according to the orders of the foreman.

In order to obtain easier ignition of the petroleum and a complete combustion, it should be mixed with 10 per cent of benzine. The mixture must be sprayed and form a cloud of about 3 feet in diameter.

Among the least dangerous and most economical sprayers — with a powerful and uniform jet to the last drop of liquid — the automatic compressed air sprayers " Pomonax ", constructed by Fritz Altmann and Co. of Berlin, and the " Calimax ", made by Carl Platz, have proved the best.

A battery of five of these sprayers allows of four being constantly at work, while one man is enough to keep them successively in pressure (figs. 1 and 2) and a sharp lad can do the lighting for four sprayers. This



Fig. 1.



Fig. 3.



Fig. 2.



Fig. 4.

is done by allowing some of the petroleum to fall on the dry grass or some straw that the boy sets on fire with a match, then withdrawing rapidly, while the man at the sprayer opens the jet by means of a small hand wheel, with which the sprayers must be fitted, and brings the spray near the flame, when it catches fire instantly. The operator directs the nozzle with care so as to project the flame on the locusts where they are thickest, first passing round the outside of the area occupied by them and then dealing with the inside.

Another sprayer that has given excellent results and may be used on uneven ground, because it can be kept in pressure even while walking, is that made by M. Marano of Acireale (figs. 3 and 4c.) It has the drawback, however, of allowing a little petroleum to leak through the packing.

This sprayer is worked by three men and allows the tins of petroleum to be used directly. The bucket sprayer constructed by Marano (fig. 4a) is also good and can be carried almost anywhere.

An excellent sprayer for flat land, possessing a strong and uniform jet and allowing working for a length of time without having to refill the reservoir (because it can contain as much as three tins of petroleum and benzine), and which stands shocks and rough usage, is the vat-shaped one constructed by Del Taglia Brothers of Signa (Florence). This sprayer, however, consumes much more petroleum than the automatic sprayers and requires four men to work it (one at the jet, one at the crank handle of the pump and two bearers). The truck on which this pump may be mounted can be used only on the flat and on ground without many stones or like hindrances ; on the other hand it can be carried by men almost everywhere by means of the iron bar which passes through the reservoir. Sprayers with rubber parts in the interior are not to be used unless no others are to be had, as petroleum with benzine acts on the rubber in such a way that valves and other parts have to be replaced every day, which is expensive.

With automatic sprayers, if worked by only one man (fig. 1), the rubber or still better oil-cloth hose that joins the pump to the rod need only be about a yard in length, while for the other sprayers it must be 8 or 10 feet long (fig. 3). The rod must be of metal, and 8 or 10 feet in length, with a good tap, and it is better for the butt-end to be fixed in a bamboo or common cane.

The *Pomonax* sprayers have a perfect rod, cased in bamboo (fig. 1.).

An excellent nozzle is the one made by Bros. Del Taglia ; the elbowed nozzle is, however, better than the straight one. After all, almost any nozzle is good, provided it gives a large mist of fine petroleum spray without waste of liquid.

In order to diminish the considerable expense caused by the corrosive action of benzine petroleum on the rubber hose, the sprayers ought to be fitted with the so-called oil-cloth hose with interior steel spiral, 6 $\frac{1}{2}$ or 10 ft. long. It must be made specially for this purpose, as it must be fitted at each end with a ring of the same material on to which the ends of the lengths of strong triple rubber hose which join the sprayer to the suction or pressure pipes or to the rod are slipped and then strongly tied. When

such oil-cloth hose cannot be had, it will be economical to cut the rubber hose where it is worn out and to join the pieces that are still good by means of tin cylinders 4 or 5 inches long and $^{5}/_{16}$ inch in diameter and with each end terminating in a raised tin ring over which the ends of the rubber pipes can be slipped and strongly tied with wire or twine.

The flame must pass rapidly over the locusts and the nozzle must be turned downwards and kept as much as possible at about one foot from the ground.

The man who directs the flame must always watch it; he must be intelligent and quick and ready to close the tap and to order pumping to stop *without turning round*, when the locusts are all burnt or in case the wind should reverse the flame ; the work must be carried out so as to have the wind always behind the flame-man, and when the wind is very strong or eddying, it is essential to stop work for fear of accidents.

The flame-man must wear leather leggings and protect his arms with cloth sleeves kept always moist with salt water, until he has acquired sufficient practice, when he can work even with bare arms.

By burning with petroleum, a considerable amount of destruction is accomplished, but not infrequently a certain number of locusts, perhaps up to 10 per cent, especially if they are large, escape the action of the flame on account of the protection afforded by the grasses, stones, dew or unevenness of the ground.

This method may be dangerous also if the men are not intelligent and quick, but its greatest drawback is its costliness.

A Marano or Del Taglia sprayer can easily consume from 14 to 20 four-gallon tins of benzined petroleum per day, and considering that this mixture in Italy averages about 1*s* 10*d* a gallon delivered on the spot, it will be seen that notwithstanding the efficacy of the system it was my duty to seek some more economical and equally radical means of control.

The experiments were made on a large scale in April 1914, with the generous aid of the Ministry of Agriculture. I was assisted by Pietro Spedalieri and Santi Schicchi. The objects aimed at were especially practical and their attainment had not previously been attempted by anyone: they consisted in the comparison of the efficiency of the several insecticides and their relative cost. The following liquids were tried: solutions of common salt, of chloride of lime, of polysulphides, of carbolic acid and of creolin, and carbolic extract of tobacco ; also water solutions of *Rubina* and *Pitteleina* and of an insecticide given to me by Cav. Ambroso, besides petroleum-soap, naphtha-soap and tar-oil -soap emulsions.

The last-named yielded the best results from both the technical and the economical points of view, and I shall limit myself to a description of this remedy. In the first place I must say that this powerful locust destroyer killed the grasses also, while the Ambroso insecticide and *Rubina* did not. I did not, however, trouble about the meagre pasture that was destroyed, because it would have met the same fate from the locusts and because between two evils it is one's duty to select the least, namely, in this case, to sacrifice a part of the pasture to save the sown crops.

In order to prepare this emulsion in the field, I had some cylindrical sheet-iron boilers made, 26 inches high and 22 in. diameter and fitted with handles. In each of these 14 ½ gallons of water were poured and the boiler was put on a fire; when the water was warm 13.2 lbs. of yellow emulsive potash soap were added and well mixed with a stick. When the soap water began to boil 6.6 gallons of heavy tar-oil was added a little at a time while continuously stirring and allowed to boil for about ten minutes. Berfore the boiler is removed from the fire some quarts of the boiling liquid are taken from it and then the emulsion is poured into a vat or open cask near the fire place.

This is the concentrated emulsion with 30 per cent of heavy tar-oil and 6 per cent of soft soap, which can be carried in casks on carts, or in tins on pack-saddles, to the spots infested by locusts. If wood costs as much as 1*s* 6*d* a cwt., a certain saving can be effected by boiling 22 gals. of water with 20 lbs. of soft soap and then pouring it into a vat containing. 100 lbs. of heavy tar-oil and mixing until a uniform liquid is obtained.

This emulsion does not keep so well as the boiled one, but if it is used the same day or the next, it is equally efficient. In exceptional cases the emulsion can be prepared without heat, but it does not seem to be so effective or so stable.

With the idea of retarding the evaporation of the emulsion sprayed on the locusts — exposed to the burning sun and wind — I added 1 or 2 per cent of common salt to the emulsion and found that it heightened its action.

This concentrated emulsion is diluted before being sprayed. As unit of measure, I have adopted the petroleum tin, because it is cheap and easy to handle and convey in boxes. To this concentrated emulsion water is added in suitable barrels and in different proportions according to the stage of the locusts ; thus to each tin of emulsion 5 of water are added when the locusts are in the first larval stage, 4 when they are somewhat larger, 3 when they have reached the nymph stage, 2 when their wings begin to appear and 1 ½ or even 1 only later and when spraying is done at night.

It will be advantageous to fit the petroleum tins with a conical spout (fig. 2), which can be closed with bits of ferula, wood or cork.

For practical purposes there is no necessity to know how and why the locusts die when they are wetted by the above emulsion; nevertheless I think it useful to say that I have always attributed its deadly action to the phenols and creosols contained in the heavy tar-oil which have a reducing action and penetrate into the spiracles of the locusts. The effect is deadlier and more rapid in proportion to the violence and suddenness of the spray, which leads me to believe that the locusts keep their spiracles open when they are quiet and shut them on being disturbed.

Dr. Alfredo Parozzani shares my opinion, but he believes that besides carbolic acid and its analogues, other bodies existing in the tar-oil, such as naphthols, pyridine bases, etc., act upon the locusts. The poisonous properties of these bodies are known : thus naphthols can cause intense convulsions and stop respiration, etc., while pyridine produces general

paralysis. When the locusts are struck by the liquid they first turn over on their backs, then jump and at last tremble, breathe heavily and die.

The soap not only causes a state of minute division of the oil in the mass of liquid but also acts as a detergent that cleanses the body of the insect of its fat and thus renders it more sensitive to the caustic action of the emulsion. This, however, is a subject more in the domain of physiologists than in mine.

The sprayers used for this emulsion are the same as those previously mentioned and they are used in the same way ; that is, the locusts are first gathered together, if they are not already in dense formation, and then sprayed.

The emulsion acts on rubber hose, making it swell and crack, so that with this system also it well be well to use oil-cloth hose.

This new system does not present any danger ; it is as efficient as the petroleum flame, and perhaps more so, and costs less than any other means of control ; for while with 1 hectolitre (22 gallons) of benzine-petroleum 2770 to 3700 square feet of ground covered with locusts can be burned, the same quantity of emulsion will be enough to spray 2150 to 3220 sq. ft. But while 1 hectolitre (22 gals.) of benzine-petroleum mixture costs about £ 2, the same quantity of emulsion for locusts in their first stages costs only about 2*s* 2*d*, *viz* : 13.2 lbs. of tar-oil, 1*s* 3*d* ; 2.2 lbs. of soft soap 4*d* ; 2.2 lbs. of salt ½ *d* ; boiling 2*d* ; water and cartage 4½*d*.

The emulsions used later cost respectively 2*s* 8*d* ; 3*s* 2*d* ; 3*s* 7*d*, and 4*s* 4*d* per hectolitre (22 gals.).

The other expenses are the same.

It must be borne in mind that the locust eggs deposited in one locality *are not hatched all at once*, but in several days, and sometimes with considerable intervals between them if the weather is unfavourable ; hence the *necessity of revisiting and perhaps of treating again the spots that have already been scorched, or sprayed with the emulsion.*

In order to avoid this, where the soil is not stony or very hard, it may be hoed to a depth of a couple of inches and the loosened soil collected in heaps and every layer rammed with a heavy rammer. In this way the pod-like masses of eggs are crushed ; a few, however, will escape and hatch out.

When the locust infestations are numerous and extensive and the locusts already adult, it is very advantageous to work during the night also, either with double shifts or giving the men a long rest between 10 in the morning and 5 or 6 in the evening. At night the locusts collect in relatively small spaces and climb up the grasses, hedges, and dry-stone walls. The night work may be done either with the petroleum flame or with the emulsion. For the illumination of the area to be attacked, acetylene lamps with reflectors carried by a man will be found useful. One lamp is enough for two sprayers, and when the area is large, the sprayers must surround the enemy to be destroyed.

I tried night work for the first time in July 1913 with the petroleum

flame, but in June and July 1914 I adopted it on a large scale with the emulsion and obtained surprising results.

The use of sheets, if they are well handled, is always helpful, especially if tar-oil is not available and petroleum has to be employed. Anyhow, even if both systems can be used, it may happen that the pumps are few or the means of transport or water insufficient.

The canvas sheets must be strong, white or nearly so, 20 feet broad by 17 ft. long ; there must be an opening in the middle to which a sack is sown, the bottom of which is closed by a string attached to the sack and is opened only when the locusts that have been caught are to be transferred to another sack.

Each sheet is entrusted to three men or tall women and a boy. The former spread the sheet where the foreman orders it to be placed ; then they weight its edges with stones and rejoin the row of beaters, who drive the locusts onto the sheet. When the locusts are about to go beyond it the three men who are entrusted with it raise the further edge so as to make a vertical screen. With this object one man goes to each corner and puts it under his arm, pressing it against his chest; the man in the middle holds it with one or both hands; thus the right hand man has his left arm free and the left hand man can use his right arm, while the one in the middle can often work with one hand. The locusts climb also onto the vertical part of the sheet, but a light flip with a finger is sufficient to make them drop. When the mass of locusts is near the sheet, the boy runs rapidly to and fro along its edge: the locusts thus disturbed jump on to it, while the others are being vigorously driven onwards. When the row of beaters reaches the sheet and most of the locusts are on it, the foreman orders the stones to be removed and the edges of the sheet to be lifted. At this moment the boy gets under the sheet and opens the upper aperture of the bag by untwisting it and closes it by twisting it up again when all the locusts on the sheet have fallen into it.

As soon as the sheet is raised so as to form a funnel, the men must not shake it but must roll up its edges beating lightly upon its sides : in this way the locusts fall into the slack of the sheet and into the sack, whence they cannot get out again, as they form an inextricable mass.

The success of the operation depends, more than one thinks, upon the care with which the work is done. A well-trained squad with an intelligent foreman can do twice and four times more execution than an inferior one. With only one sheet and with locusts already largely winged, I have collected as much as 16 cwt. in a day, that is between 8 and 9 hundred thousand.

Proceeding in this fashion, it is not necessary to empty the sack at every haul : it is enough to do so when it can no longer be carried by the boy or when it hinders the removal and spreading of the sheet. The sack is then emptied into another one so as to utilize the locusts as manure, instead of burying them on the spot. Thus the work of excavating a pit is saved and a good fertiliser is obtained.

It is evident that with the sheets not all the locusts can be caught ; besides, the sheets are not advisable when the locusts are in their first

stages or when capable of flying; on the contrary they are useful when the sun has made them active, when they are in the nymph stage or not yet strong on the wing.

The sheets cannot be used when the wind blows at all, nor when the ground is stony or covered with bracken or other plants.

In order to avoid this drawback, I had a machine constructed in the spring of 1914 ; this can easily be dismounted and can be used on windy days, on any ground and also when the locusts do not move much. It allows almost all the locusts to be trapped by having the squads of workmen go again over the ground that has already been beaten once. By turning the machine round at right angles every time, one can, without moving it from the spot, free a considerable area from locusts.

When the locusts driven by the beaters begin to arrive at the *collector* the sheet (fig. 5) is slowly wound in. The locusts that are on it when they reach the end are obliged to jump into the zinc hoppers, from which they cannot get out. The hoppers are emptied into sacks placed under them by opening a slide (fig. 6).

The *collector* was constructed under my direction by workmen of the Duke of Bronte's estate, without machinery and proper tools. Its action was not perfect but yet it yielded good results. This year still better results are expected, as it will be built with more care and precision.

The collection of the egg-masses is an old system of destroying locusts; it cannot, however, be resorted to except in case of severe infestations and in addition to other systems of control. It is a measure of prevention and of cure at the same time, and if carefully carried out it can yield excellent results and materially assist in freeing certain localities from the pest.

In order to obtain tangible and practical results, the infested belt must be visited when the locusts begin to fly and to lay eggs and the precise localities must be marked. If there is no malaria and workmen are available, it is well to seek the *ovaje* or *grillare* (small areas where the eggs have been laid) as soon as the winged locusts have disappeared. Then the soil, if it has not rained, appears riddled by superficial holes. Later this outward sign is obliterated by the rain. Then ravens, crows, calandras, and also larks, foxes and pigs, are excellent indicators of these spots. Sure guides are also certain flies that deposit their eggs in the oothecae of the locusts. One is *Cytherea obscura*, which has been described by Prof. Teodoro de Stefani, of the University of Palermo. There are others of the same family of *Bombylidae*, which the same entomologist is still studying. Two beetles are also often found : a Meloid, *Zonabris variabilis*, and a Clerid, *Trichodes ammios*, the larvae of which feed on locusts' eggs (1) De Stefani has also reported a worm and a Hymenopterous insect.

(1) Le cavallette ed i loro parassiti in Sicilia, F. de Stefani (*N. Annali Agric. Sic.*, Year XXII, Part IV. — Palermo, 1911).

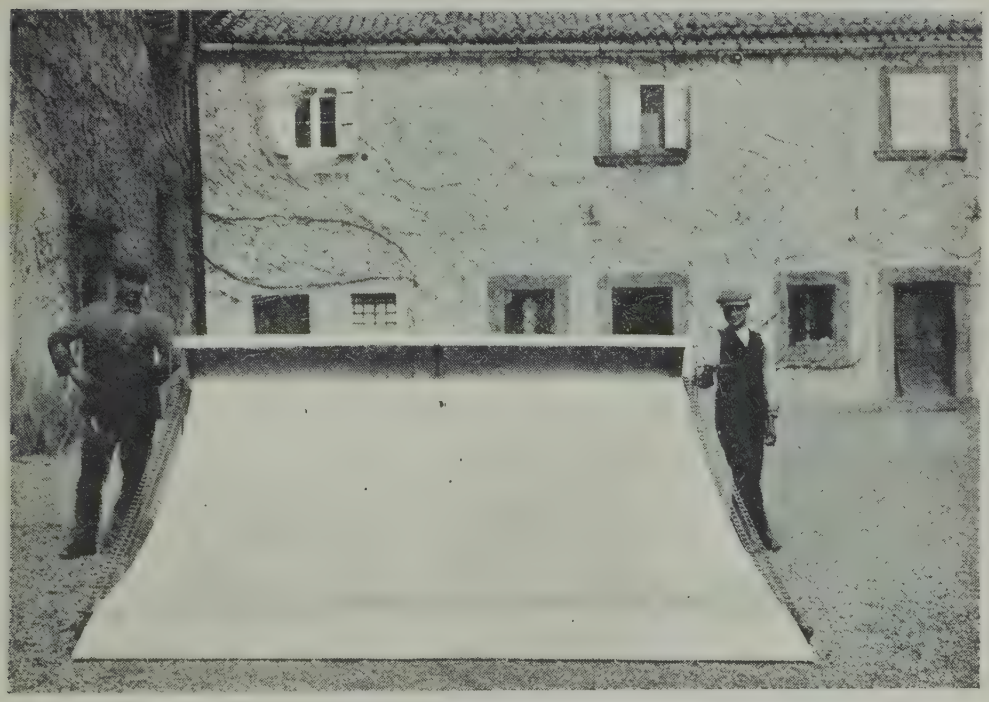


Fig. 5.

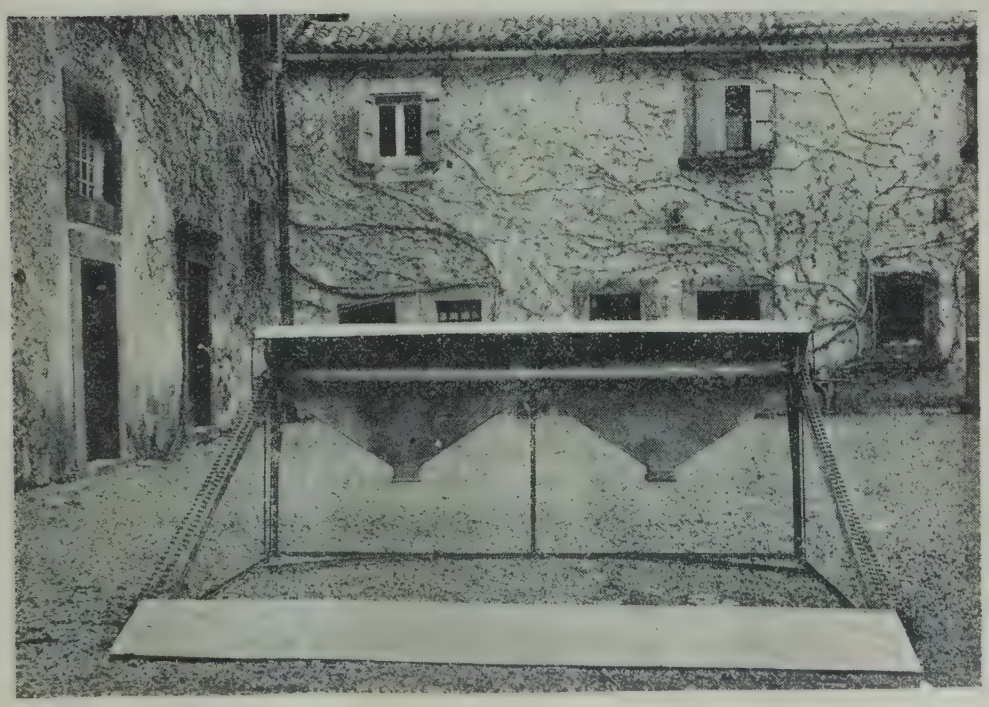


Fig. 6.

For many years past I have said and written that we must avail ourselves of the parasites of injurious insects, but I cannot agree with those among my colleagues who hope to ensure the protection of our cultivated plants by means of these parasites alone.

Returning to the subject of the *ovaje*, all the signs mentioned above are useful only when the person directing the work possesses the necessary ability ; the experienced and practised eye can also recognise the type of ground preferred by the locusts for laying their eggs. The use of a hoe removes any doubt and serves to show the extent of the *ovaia*.

When the presence of eggs is ascertained, the ground must be hoed to a depth of a couple of inches and the loosened earth heaped up and then screened. The screens must be of wire with 2 ½ or 3 meshes to the inch. They can be either large and sloping or round sieves for one man, or square or rectangular for two men, according to the quality and dryness of the soil.

The soil and the grasses that remain on the sieves are then heaped and handed over to the women, who pick out the egg-masses and place them in their aprons or baskets, from which they are transferred to the sacks in which they are taken to the burying place or special manure heap. In spite of the capacity of the women, not a few masses (up to 6 per cent) remain among the roots of the grasses and therefore these are left to dry and then burned. The collection of oothecae has been mentioned by several writers, but no one had ever said how it was to be done, and the evolution of this apparently easy work was neither short nor obvious. This work may be cheap, or too dear, according to the way it is organised and to the intelligence of the person who directs it. Zanchì (2) himself calls it a difficult and costly method (p. 69) and says that he has had hundreds of bushels gathered (p. 41), but he does not say what the expense was.

From October 26, 1913, to March 30, 1914, almost 100 tons of locusts' eggs were collected under my direction. They represented 6500 millions of insects, and the whole outlay was £ 1240. Every million eggs thus cost about 4*s*, including the piece-work at 2 ¾*d* per lb.; the picking done by day labourers cost from ¾*d* to 1 ¾*d*, or an average of 1.38*d*, per lb. containing about 29 000 eggs. If the masses cost more than 2 ½*d* per lb. to collect, I do not think it pays.

I consider it my duty to say in conclusion that in the presence of severe infestations of locusts such as represent real calamities, one may, and sometimes must, use every means (with the exception of ploughing and hoeing, which are of very little benefit and usually cannot be carried out) without sacrificing the technical results to the strictest economy. However high the expense may be, it can never represent more than a small part of the damage that the locusts are capable of causing.

It should be borne in mind that according to experiments — which, for their special nature, cannot always yield the same figures when checked — it has been found that the destruction of a million locusts costs from

(2) *Delle cavallette e del modo di distruggerle.* — Palermo, 1859.

12*s* 6*d* to 25*s* when petroleum is used ; 16*s* to 32*s* with the sheets, and 1*s* 8*d* to 5*s* 10*d* with the emulsion. Picking the eggs may cost from 4*s* 2*d* to 25*s*. and upwards per million.

From April 16 to July 11, 1914, in the Communes of Bronte and Maletto (Catania), we disinfected with the emulsion of heavy tar-oil about 1185 acres of land *covered* with locusts, destroying about 880 000 lbs. of locusts small and large, whilst with the sheets we captured 198 000 lbs. of locusts in the nymph and winged stages. From these calculations, which are relatively approximate, but trustworthy, it is estimated that perhaps 12 000 millions of locusts have been destroyed at a cost of £1440.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

343 - **Agricultural Progress of the Province of Saskatchewan.** — *Government of the Province of Saskatchewan, Department of Agriculture*, 64. pp. Regina, Sask., 1914.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES,

This handbook of the Bureau of Information and Statistics contains information concerning the country's resources and the opportunities which it offers to every phase of collective and individual enterprise.

Up to 1897 there was very little improvement in the condition of the people in the province of Saskatchewan. At the present time they are in an enviable situation and there is no country where the farmers are better organised for the protection of their own interests. They have the Grain Growers' Association and the Saskatchewan Cooperative Elevator Company. Both of these look after the interests of the grain raiser in every way. There are horse, cattle, sheep, swine and poultry breeders' associations and numerous Agricultural Societies, all of which are liberally aided by the Provincial Government. The amounts of the cash grants for these Associations have increased from $9 000 in the year 1904 to $64 600 in 1914. Foreign capital is coming into the country faster than ever before, showing the confidence which financiers are bound to feel in her development. British capital is coming in at the rate of 200 million dollars a year.

Saskatchewan has a *total land area* of 155 764 000 acres, of which 75 216 863 acres have been surveyed and 13 520 490 acres are under cultivation.

Of the surveyed area 26 000 000 acres are under homesteads, 5 400 000 acres under pre-emptions and purchased homesteads, 15 177 063 acres

granted to Railway Companies, 2 000 000 acres reserved for forestry; 9 100 000 acres are now available for entry.

The *value of land* has increased very rapidly during late years, and in 1912 the increase in the value over the two previous years was fully 25 per cent. The average price of improved land runs from $23 to $30 and for unimproved from $15 to $22 per acre. The prices depend more on the situation of the land than on the quality, land in older settled districts and nearer to a railway being naturally more expensive.

The *soil* is exceedingly rich in nitrogen, potash, lime and phosphoric acid and the favourable physical condition is due chiefly to the large proportion of semi-decomposed vegetable matter.

The *annual precipitation* is comparatively light, but the greater part of the rain falls during the growing season and hence is particularly effective agriculturally.

Crops.— With a wheat crop greater than that produced by the remainder of Canada, only sixteen per cent of the arable land in the southern half or settled portion of the province is under cultivation. The crop production alone in 1913 represented a return of $185 per capita of the total population of the province. The total value to the farmer of grain, root and fodder crops raised in 1913 was almost 126 million dollars, with 150 million dollars of live stock on the farm.

The most successful crops of *wheat* are grown on land ploughed in June or early in July, and disked, dragged and rolled, thereby thoroughly eliminating weeds and conserving the moisture. Then for the next two or three years crops are grown. The second and third crops on this summer fallow are produced with large profit. The work of breaking up the prairie and planting crops on large areas, using steam power, is accomplished at a cost of from $2.50 to $3.50 per acre.

The season 1913 closed with 192 *elevators* representing storage capacity of 5 840 000 bushels, making a total of 1431 elevators with a total capacity of 44 294 000 bushels.

All Saskatchewan grain is sold according to grades established by Dominion law. The *average price* received by the farmers for the *wheat crop* (all grades) of 1913 was 66 $^1/_8$ cents per bushel of 60 pounds, making the total wheat crop worth to the producers $74 304 269. The *oat crop* of 1913, at an average price of 24 $^3/_4$ cents per bushel, was worth to the producers $27 277 082.

Live stock.— There were 609 500 horses, 322 790 milch cows, 534 460 other cattle, in addition to thousands of sheep and swine in the province in 1913.

Each year thousands of two-year-old steers are imported into Saskatchewan from Texas and other western States of the Union and placed upon ranches in the province. When in prime condition they are shipped back to the Chicago stock market as beef cattle. The ranching industry in Saskatchewan is by no means extensive and within a decade or so, at the present rate of settlement, will probably cease to exist entirely.

The price of teams is high. Horses weighing about 1500 pounds will

fetch from $250 to $300. At the end of July, 1913, there were 1497 pure bred and 258 grade stallions in the province.

The *dairy industry* is also being firmly established in many sections, largely assisted by the present government creamery system, and the infusion of pure-bred dairy stock from eastern Canada. The number of farmers supplying cream has risen from 553 in 1908 to 2681 in 1913.

Two-thirds of the province is admirably adapted to *sheep raising*, and every encouragement is being offered the would-be sheep breeder to take up this work. The English Down breeds are preferred on account of their hardiness, prolificacy and early maturity.

Swine are also raised economically and profitably in this province. The bacon type of hog is preferred, the Improved Yorkshire being probably the greatest favourite; but the lard type is also coming into prominence and breeders are proving that this latter kind can be as profitably raised in the wheat belt of Saskatchewan as in the corn belt of the United States.

There are five million birds in the *ponltry industry* of the province and yet more than 75 per cent of the egg supply is imported.

Colonisation. — In 1908 a great change was inaugurated in the land settlement policy. All agricultural land became open to settlement and the pre-emption system was introduced. Under this plan the man who already had a homestead is allowed to purchase another at the price of $3 per acre within a certain area. The man just taking up his first homestead in this area is allowed to purchase an adjoining quarter section, so that by doubling the terms of improvement required on a homestead and by the payment of $480 he is able to get 320 acres instead of 160. The result of the policy has been an extraordinary increase in the rate of settlement. The homestead duties are: 1) residence thereon for six months in each of three years; 2) cultivation of 30 acres, a reasonable proportion being done each year; 3) the erection of a house worth at least $300 when making application for patent. The homesteader becomes entitled to patent for pre-emption by: 1) residence for six months in each of six years on either homestead or pre-emption; 2) erecting a house on homestead or pre-emption to be worth $300; 3) cultivating 50 acres in addition to the 30 acres on homestead, in all 80 acres, a reasonable proportion to be done each year; 4) paying for pre-emption at rate of $3 per acre, payable one-third three years after date of entry, balance in five equal annual instalments with interest at 5 per cent from date of entry, payable yearly.

Three new districts are now open for entry: the Melfort and Carrot River district with 5000 homesteads; the Prince Albert and Hudson Bay Route with 11 500 homesteads; the Shellbrook Marcelin and Big River district with some 6000 homesteads.

The cost of settling on 160 acres is from $1300 to $2000.

344 – **Development of Agriculture in Japan** (1). — *Ministère des Finances, Annuaire Financier et Economique du Japon*, Year XIV, pp. 46-54. Tokyo, 1914.

Sixty per cent of the people in Japan are engaged in agricultural pursuits. In 1914 the *area subject to land tax* was 36 356 594 acres, divided as follows :

	acres		acres
Rice-fields	7 158 634	Non-afforested plains .	3 149 257
Arable land	5 980 270	Other lands	31 294
Forests	19 178 568	Ponds and swamps. .	31 438
Pastures	103 679		

The difference between these items and the whole includes the surface occupied by buildings, salt works and mineral springs. On March 31, 1913, the *total area of forests* (both those subject to land tax and those exempt from it) was 46 318 550 acres, of which 19.5 millions belong to the State and about 4.2 millions to the Imperial Household. At the same time the *mountains and plains not under forest* (both those subject to and those exempt from land tax) amounted to 5 338 202 acres, of which about 323 400 belong to the State and 360 150 to the Imperial Household. The fluctuations in the chief crops during the period 1904-12 are shown by the table opposite.

Thanks to the fertility of its soil and the humidity of its climate, Japan is very rich in forests ; thus the land under forests or susceptible of being afforested is estimated at 69 706 013 acres, or 73.1 per cent of the whole area. Up to within a few years ago the forests were not utilised to any great extent, but of late years this utilisation has made great progress. In 1912 the forests of Japan proper yielded :

	cubic feet	£
Timber.	1 008 609 646	8 146 960
Bamboos	37 713 642	257 140
By-products.	—	2 160 332

The value of products derived from wood (charcoal, acetic acid, gum, pitch, resin, lamp-black, wood pulp, camphor and oil of camphor) amounted to £ 2 691 266. In 1912, 354 289 acres were reafforested at a cost of £ 440 064.

According to the law on forest management of 1907 the Forest Administration is empowered to prevent deforestation and to promote reafforestation. A project for improving watercourses has been drawn up ; its execution will require 19 years from 1911. In pursuance of this project meteorological observatories will be erected in the most important forest centres in order to determine the relation between climate and forests ; special grants will be allowed for the reconstitution of national forests, for

(1) See also *B.* April 1911, No. 1086 ; *B.* Jan. 1912, No. 9 ; *B.* July 1912, No. 1083 ; Dr. Yokoi Tokyoshi : Agricultural Economy of Japan : Principal Features : Present Condition, *B.* March 1913, pp. 331-336. (*Ed.*)

the reafforestation of waste lands belonging to the State, and for the protection of these against erosion, etc. The area of State property to be reafforested is estimated at about 12 million acres, or 30.7 per cent of the total area of woods and waste lands.

Area and yield of crops in Japan, 1904 and 1912.

Crops	Area		Yield	
	1904	1912	1904	1912
	Acres		Bushels	
Rice	7 059 768	7 359 583	255 093 896	249 137 865
Barley	1 597 075	1 465 766	44 278 044	48 561 917
Rye	1 691 152	1 666 621	34 006 911	39 184 556
Wheat	1 123 996	1 216 361	19 140 596	25 690 320
Millet	83 076	81 684	1 783 324	1 894 970
Soya (daizu)	1 095 081	1 165 734	18 405 877	17 416 862
Lentils	308 857	335 018	3 621 281	4 697 840
Italian millet	523 545	442 449	9 825 706	9 173 205
Buckwheat	410 919	359 378	5 834 066	4 944 039
Rapeseed	356 707	335 743	5 505 402	5 057 950
			Short tons	
Potatoes	115 884	172 931	338 205	770 039
Sweet potatoes	685 642	733 558	2 730 156	4 052 406
Cotton (unginned)	31 541	6 759	11 659	3 625
Hemp	38 518	29 776	11 273	8 826
Indigo (leaves)	60 442	12 276	37 917	11 641
Sugarcane	38 520	51 293	464 174	879 590
Tea	124 451	73 367	31 005	36 284
Tobacco (leaves)	73 707	68 024	47 563	37 446
Shellac	—	—	208	294
Vegetable wax	—	—	15 391	12 730
			Bushels	
Cocoons	—	—	14 149 273	22 083 443

Rearrangement of arable land. — In 1899 a law was enacted for the "regularisation of arable lands" which was modified in 1909. It promotes the cultivation of waste lands and the restreaking of small properties, the improvement of rural roads, of irrigation canals, etc., and the spread of agricultural machinery. This law has already yielded very beneficial results. In order to preserve and improve the sources and water reserves

and to prevent floods, the Government have recognized the formation of associations for the utilisation of watercourses to be of public utility.

Control of plant diseases. — Another law has been enacted for the avoidance and control of plant diseases. All plants for exportation are inspected by the Government's agents in the ports of Yokohama and Kobé. On March 25, 1914, a law was passed on the quarantine of imported or exported plants. It came into vigour at the end of 1914.

Live stock. — With the object of promoting stock breeding the Government have established three breeding farms (for cattle, sheep and pigs) and a poultry farm; besides the improvement of live stock, forage crops and industries connected with animal husbandry are dealt with in these farms. There are at present in existence three national horse-breeding farms; one central remount depot and 15 district depots. In 1907 the law on the inspection of bulls was approved; the law on the inspection of stallions dates from 1897.

Live stock in Japan, 1904 and 1912.

	Total number		Increase	Number slaughtered		Increase (+) or decrease (—)
	In 1904	In 1912		In 1904	In 1912	
Cattle	1 200 135	1 399 498	199 363	296 971	297 370	+ 399
Horses	1 390 017	1 581 743	191 726	44 651	64 431	+ 19 780
Sheep	2 769	3 308	539	7 609	7 487	— 122
Goats	67 972	101 475	33 503			
Pigs	191 952	308 970	117 018	110 879	213 993	+ 103 114

A regulation for the encouragement of breeding was published in 1908. In 1891 the Imperial Institute for the Study of the Contagious Diseases of Animals was founded, and in 1911 the Laboratory for the Preparation of Serum against Cattle Plague. Preventive laws against the diseases of live stock and against bovine tuberculosis are in force.

Silkworm rearing. — In order to prevent the spread of the silkworm diseases, a long time ago the law on the inspection of silkworm eggs was enacted; in 1905 it was replaced by the law for the prevention of the diseases of silkworms, and this in its turn was substituted in 1911 by another one, which not only regulates preventive measures against the above diseases, but also the unification of the qualities of cocoons, the associations of silk producers and the control of their industry.

There are two National Institutions for instruction in sericulture, which also conduct scientific experimentation; other schools of sericulture have been founded by local corporations. In 1906 the Government founded at Yokohama an establishment for the examination of silk. In 1911-12 a National Laboratory for the production of silkworm eggs, with four branch

All the hybrids obtained will be entered in the Central Ampelological Collection of the Ampelographic Institute, situated at Köbánya near Budapest, in groups of 25 as parent stocks, the buds of which will be distributed to the provincial experiment stations according to the peculiarities of soil, climate, etc.

Although it is not yet possible to judge the merits of the hybrids already obtained, the following stocks are considered to be worthy of special attention :

Olasz — Rizling × Riparia — Rupestris Pécs, Nos. 47 and 47-1.
» — » × Berlandieri — Riparia 157 Pécs, No. 49-1.
» — » × Riparia — Portalis No. 50.
Furmint × Rupestris du Lot No. 56.

388 – **Experiments on the Forcing of Grafted Vines by Various Systems, made at the Royal Oenological School of Conegliano, Italy.** — DALMASSO, G., and SULTO, S. in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXI, Series V, No. 3, pp. 49-55. Conegliano, February 1915.

Comparative experiments have already been carried out at Conegliano on Richter's system of forcing, which was found to be too costly. Since then the following methods have been investigated : 1) in hot beds ; 2) in sand under glass ; 3) in sand without glass.

The average percentages of success with the various methods were 73.6 in hot beds, 73.4 in sand under glass and 47.4 in sand without glass. Forcing in sand under glass is superior to forcing in hot beds as regards vigour of rooted grafts after planting out in the nursery. Forcing in sand without glass was unsuccessful for the number of plants striking and their vigour.

For forcing in sand under glass, the grafted cuttings are placed in sand in frames, with the lights sloped at 45° and facing south. This system has been greatly extended in Apulia by Prof. PROSPERI of Barletta, but it is less known in Northern Italy, where these experiments were conducted.

Considering the good results and the economy of this system of forcing compared with that in hot-houses, and also its simplicity and facility of application, it is recommended even for the smallest growers, since it enables them to prepare material for the reconstitution of their vineyards at home and at a minimum of expense.

389 – **Vine Stocks for Saline Soils.** — RAVAZ, L., in *Le Progrès agricole et viticole*, Year 32, No. 6, pp. 121-124. Montpellier, February 7, 1915.

The discovery of a stock which is resistant to saline soils would be of great importance, since in the coast zones, and sometimes also in the interior of hot countries, there is saline soil that could very profitably be used for vine-growing, as it is generally most fertile. Further, salt-pots occasionally appear, even in old vineyards in temperate countries, and these might disappear with the use of a suitable stock.

For some time, Solonis has been the only stock planted in ground containing much salt ; but this vine is beginning to lose favour, having shown itself to be a little weak and not always sufficiently resistant to phylloxera.

Every effort has been made in many places to try the new hybrids, but the results have, so far, not agreed. The following observations are quoted as a contribution to the study of the question.

MM. CHAULIAC and VERMEIL state that in the neighborhood of Oran and Mostaganem (Algeria), where much of the soil contains large amounts of chlorides and the irrigation water is also often saline, the vine most susceptible to the action of salt is 3309, and the American vines there are much more susceptible than the French. It is unwise to plant the former if the soil contains over 1.5 per thousand of chlorides, while the latter in ordinary seasons will put up with as much as 3 per thousand. The amount in the irrigation water may be slightly larger, *viz.* up to 2 per thousand. If the chloride content reaches 2.5 per 1000 the water must be given very sparingly, while if it is 3 per thousand, the water cannot be used for irrigating American vines. French beans, which are very susceptible to chloride, can be used as an index.

M. VIVET advises that vineyards should not be planted on soils containing over 1 per thousand of chlorides, and that only such stocks should be used as are resistant to damp and to salts.

In the department of Algiers, the leaves of the grafts on 3306 were entirely scorched on soils which contained, at the end of the summer, only 0.47 per thousand of chlorides. On Mourvèdre × Rupestris 1202, the grafts remained bright green on soil containing up to 0.77 per thousand of chlorides, but their leaves were for the most part scorched where the chloride percentage rose beyond 1 per thousand, and they did not shoot in spring where it exceeded 2 per thousand. No. 3309 on its own roots is completely scorched in soil with ½ per thousand of chlorides, while Solonis × Riparia 1616 remains green. In soil with 1 per thousand of chlorides 1616 suffers greatly, while Aramon × Rupestris Ganzin Nos. 1 and 9 have hitherto borne this percentage of salts.

In soil containing above 1 per thousand of chlorides it is not advisable to plant vineyards. Where the percentage is lower, it is necessary to drain the ground well, in order that the salt water may be carried off. Where the chloride percentage is below 0.4 per thousand, Riparia and Riparia × Rupestris 3306, 3309 and 101-14 should not be planted, but rather 1202 or Aramon × Rupestris Ganzin Nos. 1 and 9. The last-named, which is recommended for planting on dry soils, is very vigorous and has borne a little over 1 per thousand of chlorides. Gamay-Couderc 3103 is the vine which has stood the highest amounts of salts in Orania (at Saint-Cloud it bore up to 2 per thousand when on its own roots, but died when grafted). It is therefore advisable that these two vines should be given a special trial where the soil contains up to 1 per thousand of chlorides.

BIBLIOGRAPHICAL NOTE.

390 – SAVASTANO, LUIGI (Director of the Royal Station for Citrus and Fruit Growing at Acireale). *Arboricoltura* (Fruit Growing) (1). — Naples, Francesco Giannini e Figli, 1914 (1 vol. in-8vo, pp. XI + 848, 268 figs.).

This treatise, which is developed with original criteria, is the result of the writer's many years' experience and of the studies and observations made by him, chiefly in the Sorrento peninsula, near Naples. It is divided into six parts, each of which begins with an exposition of the method followed (the treatment of the various subjects is different in the theoretical and the practical parts) and is followed by a summary of the conclusions and by a bibliography. The life-history of the cultivated tree and the methods of cultivation are dealt with in detail. The drawings and illustrations are almost all original. The book is furnished with four exhaustive indexes: a general index, a geographical index and one of the species and of the authors respectively.

The work is divided into the following parts:

Part I. *Fruit Growing in Civilised Countries.*
Part II. *The Life-history of the Cultivated Tree.*
Part III. *The Technique of Fruit Growing.*
Part IV. *Planting the Orchard.*
Part V. *In the Orchard: Cultural Work, Fruit Picking,* etc.
Part VI. *Conclusion, Systematic Cultivation of Fruit Trees.*

391 – **Variation of Colour in the Seeds of *Pinus nigricans*.** — PITAUER, in *Centralblatt für dass gesamte Forstwesen*, Year 40, Part 5-6, pp. 185-202. Vienna, May-June 1914. FORESTRY

Every sample of seed of Austrian pine (*Pinus nigricans*, = *P. laricio austriaca*) shows variations in colour from yellowish-white to deep dull black.

Selecting from this range of colours the intensely black and the purest white seeds, an experiment was begun to determine whether there are two kinds of *Pinus nigricans*, the one producing light and the other dark seeds. All individuals bearing seeds of mixed colouring were regarded as hybrids of the two types to be established.

The investigations so far made have yielded the following results:

1. The percentage of wholly light seeds in the samples from the northern area of supply (Lower Austria) was more than double that in the sample from the southern area (Dalmatia), the figures being 10.56 and 5.13 per cent.

2. The weight per thousand of quite light-coloured, but full-grained, seeds was throughout less (average 17 per cent) than that of the wholly dark seeds.

3. When fresh, the pale seeds germinated more slowly than the dark, when grown beneath colourless, yellow, or black bell-glasses. In a blue light, on the contrary, there was no difference in the behaviour of these differently coloured seeds. After having been kept for about a year at room tempe-

(1) Under the title of "Arboricultura" the author considers the cultivation of all woody plants producing fruits and nuts, including *Vaccinium* but not *Fragaria*. (*Ed.*).

rature with free access of light and air, the pale seeds germinated conspicuously faster than the dark, when in a blue light. Under yellow and colourless bell-glasses the germination of the two categories of seeds was about the same and it was only by cutting off the light that the dark seeds could be made to outstrip the pale ones.

These results permit of the preliminary hypothesis that the light coloration is an adaptation to the conditions of light under the shade of dense stands, or in northern latitudes, while the dark is an adaptation to the conditions obtaining on open sunny spaces and in more southern districts. The confirmation of this hypothesis is the object of further experiments which have already been begun.

392 – **Researches on Larches from the Alps and the Sudete Mountains.** — CIESLAR, A., in *Centralblatt für das gesamte Forstwesen*, Year 40, Part 5-6, pp. 171-184. Vienna, May-June 1914.

In 1907 the writer gave an account of a comparative cultivation experiment with larches from the Alps and the Sudete begun in 1888 in the Mariabrunn forestry garden and finally arranged in 1891 in the Gablitz portion of the Forestry Division of Purkersdorf, in the Wienerwald.

It had already been established by the first experiments that the larches native to the Moravian-Silesian Sudete behaved somewhat differently from a biological point of view from those coming from the Alps. The differences observed in the height of the trees, the variations in the development of the trunks and crowns, the thickness of the bark, the date of budding and of leaf-fall, as well as in the specific dry weight of the wood, are all to be attributed to the special climatic factors of the two regions.

In the autumn of 1911, the studies were resumed in the Gablitz experimental ground, which had been planted in 1891 with three-year-old Silesian and Alpine larches, the object being to examine more in detail the forest-forming and biological characters of the Alpine and Sudete trees and to test how far the two forms are distinguished by characters requiring different treatment in the forest. The two lots of seed originally used for this experiment had been obtained from the Freudenthal Forest Station and from the Telfs National Forest in the Northern Tyrol.

Considering the great extent and the extraordinarly different climatic factors of the distribution area of the Alpine larches, the writer lays stress upon the fact that the following results are to be regarded as in the first place only referring to the seeds used in the Gablitz cultivation experiments.

1. The larch of the Sudete Mts. differs from that of the Alps in standing shade much better.

2. Up to at least its 27th year, the Sudete larch shows more rapid growth in height than the Alpine. Sudete larches mixed with silver fir, spruce and beech grow more easily and are of greater economic value than Alpine larches from high situations under the same conditions.

3. The Sudete larches were characterised by their perfectly straight trunks.

4. The trunks of the Alpine larches have much waste wood in their lower portions; the Sudete larches produce trunks with a larger amount of sound wood.

5. The formation of heartwood proceeds more rapidly in the Sudete larches, so that young Sudete larches have a larger percentage of heartwood than young Alpine larches.

6. Neither static momenta nor the need of equal water-conducting capacity alone determines the shape of the trunks, but both factors play a part in the formative process.

7. The wood of every part of the Sudete larch is considerably heavier than that of the Alpine, the difference in weight being greatest in the lower portion of the trunk.

8. In mass performance there is but a negligible difference in the single trunk of either tree.

9. It would be greatly in the interests of forestry that Polish larches also should be more thoroughly investigated.

393 – **Experiments with Light-demanding Trees on Heaths in Denmark.** — HELMS, JOHS., in *Det Forstlige Forsøgsvaesen i Danmark*, Vol. IV, Part 3, pp. 269-292 + 19 figs. (Summary in German, pp. 292-294). Copenhagen, April 22, 1914.

Experiments with light-demanding trees were commenced in the spring of 1912 in the Feldborg forest district in the north-west of Jutland, between Viborg and Holstebro. The soil is a good heath soil, without hardpan, on a gravel subsoil. The report on the arrangement of the experiment and on the devlopment of the plants grown up to the end of 1907 was published in *Det Forstlige Forsøgsvaesen i Danmark*, Vol. II, 1909. This report deals with the results up to the present.

METEOROLOGICAL CONDITIONS. — The six years between 1908 and 1913 included two severe winters, 1909-10 and 1911-12; in the springs of 1911 and 1913 there were late frosts; the springs of 1908, 1909 and 1912 were late. No summer presented features which could hinder the development of the plants.

DEVELOPMENT OF THE TREES. — Oaks (*Quercus sessiliflora* and *Q. robur*, = *pedunculata*). — During the earlier years the development was satisfactory; later the trees suffered from late frosts, so that their growth was much slower; *Q. sessiliflora* suffered more as its buds open earlier. These oaks can survive in the locality in question, but as they grow very slowly it is not worth while planting large stands on the Danish heaths; at most they may be used for shelter belts.

Aspen (*Populus tremula*). — The climatic conditions were too unfavourable and the soil perhaps too shallow to allow of satisfactory development.

Grey poplar (*P. canescens*) did not stand the late frosts.

Pinus montana ("Fransk Bjaergfyr"). — The experiments showed that plants obtained from seed produced in Denmark develop much less than the plants produced from imported seed, which is probably due to hybridisation in the experimental plantations. The intermediate form obtained will be subjected to further observation, in order to determine to what extent

it approaches the extreme forms from which it is derived and if it possesses a greater resistance to *Lophodermium pinastri* than the plants sprung from imported seed.

Scots pine (*Pinus sylvestris*). — Notwithstanding the strong winds which caused great evaporation in spring and consequent loss of needles, and the attacks of *Melampsora pinitorqua*, the plants developed satisfactorily, and it is believed that these trees can be recommended for fairly good heath soils, especially in rather sheltered localities.

Pinus murrayana var. *sargenti* Mayr. — The plants have so far developed fairly well and have not suffered at all from the strong winds. Of late years, however, the presence of many bark wounds with issue of resin has been observed ; they have weakened the affected plants and in some cases have killed them. No animal or fungoid organism has been found to cause the disease, which is considered to have a purely physiological cause ; perhaps due to the action of frost.

Pinus banksiana Lambert. — It grows very rapidly, though it suffers somewhat from the high winds, which cause loss of needles and bending and twisting of the stems.

Pinus rigida Miller. — It is injured by the severe winters, by late frosts and by the too strong evaporation in spring. In the experimental plantation most of the stems are twisted, but notwithstanding the unfavourable conditions, the trees developed very well.

Pinus contorta Douglas. — The development was particularly good. The plants were not noticeably injured by the wind, but they do not stand the severe winters of the locality.

Pinus ponderosa scopulorum Engelmann. — It does not resist the cold in winter, and grows very slowly.

Pinus balfouriana var. *aristata* Engelmann. — Grows with extraordinary slowness and is much damaged by late frosts.

394 - **Experiments in Growing Oaks of Different Origins in Denmark.** — HAUCH, L. A., in *Det forstlige Forsogsvaesen i Danmark*, Vol. IV, Part 1, pp. 295-316 + 8 figs. (Summary in German, pp. 317-318). Copenhagen, September 21, 1914.

The Forest Experiment Department in Denmark has arranged an experiment to determine the effect of the different place of origin of the acorns on the development of the oaks springing from them. This experiment was conducted in the 1st. forest district of the Sorø College. Twelve plots were sown, each with acorns from a different locality, as follows : Plot I, acorns from Hald Egeskov (Jutland) ; Plots II and III, acorns from Bregentved (Seeland) ; IV, from Holland ; V, from Russia (Government of Poltava) ; VI, from Galicia (Szeparovic Kalomea) ; VII, from Hungary (Selmecsbánya) ; VIII, from Slavonia (Rajic) ; IX, from Moravia (Göding) ; X, from Bregentved (twisted parent trees) ; XI, from Montona near Triest ; XII, from Hanover. In each case except X, the acorns were from a single good stand of *Quercus robur* (= *pedunculata*). Plots I-IV were sown in the spring of 1909 ; V to X in the spring of 1910 ; plot XI in the spring of 1911 ; and plot XII in the spring of 1912.

The area under experiment is now covered by a dense vegetation of young trees. In most of the plots in the year after the sowing there were about 80 000 plants to the acre, with the exception of plot X, where only a small portion of the seed had grown, and of plot XI, where the acorns had probably been rifled by jays. The plants of different origin showed considerable differences: at the inspections which were made every spring, and especially at that made in the spring of 1913, the various plots showed differences in the presence and development of summer shoots.

In plots V-IX almost all the plants had formed summer shoots; in plot I many plants had formed only spring shoots with vigorous buds; likewise in plots II and III, where, however, they were much less numerous; the plants in plot X resembled in this respect those in II and III. The summer shoots were stoutest in the oaks of Danish origin, plots I-III; these were followed by the plants in plot IV (Dutch); the thinnest, weakest and longest were in plots VI-IX (Austrian and Hungarian oaks). The formation of long and thin summer shoots means a less spread of crown. Plot I (on which there are possibly crosses with *Q. sessiliflora*) is singular in that the plants keep their old leaves throughout the winter.

Differences were also observed in the opening of the buds: whilst on April 28, 1913, this had made much progress in plots V, VII and IX, in the others it had not yet commenced.

Differences were also observed in the structure of the shoots and the development of the buds, but the differences in colour-change and leaf-fall in autumn were not marked, though the foreign oaks were behind the Danish ones in changing.

The oaks were affected by mildew, especially in 1910, and the foreign ones suffered a little more than the native oaks, but the difference between the plants of different origin was not very great.

Examination in February 1914 showed that the oaks of plots V-IX presented a remarkable difference in the conformation of the shoots compared with those of previous years. Many of them had only small weak spring shoots, most of which had produced short and thin summer shoots; this appears to have been due to late frosts of the preceding year.

395 – **Methods Adopted to Facilitate the Germination of Juniper and Acacia Seeds.** BALDRATI, I., in *L'Agricoltura italiana*, Year XL, Part 781, pp. 680-684. Pisa, November 30, 1914.

The writer obtained good results in Eritrea, from the following methods devised by him:

Juniper seeds. — The berries, gathered at a suitable stage of ripeness, are dried in the sun for about ten days; they are then placed in water for four or five days and occasionally stirred; a good fermentation is thus obtained; the fermenting mass is then well worked up until the seeds are freed and cleaned. They are then rinsed in water that has been warmed in the sun and immediately sown in beds. If the sowing is done at the beginning of the rainy season the seeds germinate uniformly within four to six weeks.

Acacia seeds. — Acacias, which, besides being valuable for several economic purposes, possess also a great resistance to the inclement tropical and subtropical meteorological conditions, and a marked rapidity of development, are very popular where rapid reafforestation is required. But the seeds of all the best acacias germinate with difficulty and not uniformly ; hence the importance of methods for facilitating the process and rendering it uniform.

With small parcels of seeds, the writer has obtained excellent results by steeping them for twelve hours in water, then enclosing them in moist woollen bags placed in glass-stoppered bottles exposed to the sun. In about ten days, 98 per cent of the seeds germinate ; the seeds are taken out and sown as fast as the radicles appear.

When dealing with large quantities of seed, they are placed in vessels with boiling water and covered with sacks and kept in enclosed spaces so as to delay cooling. After two to four days they are sown in moist ground. It is necessary to sow at the time of the regular rains or to water copiously. With this method the writer has successfully sown : *A. cyanophylla, A. pycnacantha, A. decurrens, A. farnesiana, A. longifolia, A. cultriformis, A. cyclops* and others ; with some other species, such as *A. abyssinica*, this method gave negative results, while the sulphuric acid treatment recommended by ZIMMERMANN and described some years previously by Prof. TODARO (Royal Agricultural Experiment Station, Modena, 1901) was successful. The writer generally obtained germination of 30 to 35 per cent in one month from *A. cyanophylla* and 25 to 30 per cent from *A. pycnacantha*. Usually he kept the seeds four hours immersed in concentrated sulphuric acid, but those of *A. pycnacantha* are too deeply attacked by so long a treatment, while other seeds can stand it for six hours and upwards. On the whole the sulphuric acid treatment did not yield any better results than the hot-water method ; consequently when this is applicable it is always to be preferred, as it avoids the use of so dangerous a substance as concentrated sulphuric acid.

The writer has had good results with the alcohol treatment (four hours' immersion) suggested by VERSCHAFFELT ; he finds it, however, too costly to used on a large scale.

396 - **Notes on Germination and Reproduction of Longleaf Pine (*Pinus palustris*, = *australis*) in Southern Mississippi.** — BUTTRICK, P. L., in *Forestry Quarterly*, Vol. XII, No. 4, pp. 532-537 + 1 plate. Washington, D. C., December 1914.

Investigations on the dispersal and germination of the seed, and growth of the seedlings, of *Pinus palustris* have shown that : 1) the seeds are not liable to be carried more than 150 feet from the seed trees; 2) the seeds will not germinate on a heavy litter; 3) germination takes place best on mineral soil from which the litter has been burned ; 4) most of the seedlings perish from fire, drought, or shade before the end of the first season ; 5) one-year-old seedlings will often withstand surface fires where the litter is only the accumulation of a single year ; 6) under favourable conditions of soil, moisture, and light, the seedlings can withstand

annual fires after their first season for at least 10 years or more; 7) such fires however retard their growth in height at least 50 per cent for the first decade.

LIVE STOCK AND BREEDING.

397 – **Experiments on Inmunisation against Anthrax.** — HOLMES, J. D. E. (Imperial Bacteriologist) in *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No. 7, pp. 199-206. Calcutta, September 1914. HYGIENE

The method of immunisation against anthrax by means of the simultaneous injection of serum with the inoculation of an attenuated culture is not free from risk. A varying number of inoculation mortalities follow. Inoculation with serum confers an active immunity but it does not protect in all cases and the results are variable. Inoculation with the vaccine alone did not confer any immunity. The use of an attenuated culture in combination with anti-serum does not appear to be a method in any way superior to the combination of a virulent culture with anti-serum. With both methods a varying percentage of mortality occurs, and although an active immunity is produced in the animals which do not succumb, this immunity does not extend to all cases and a certain number of animals remain susceptible to infection.

398 – **Tuberculosis in Donkeys.** — SCHLEGEL, in *Berliner Tierärztliche Wochenschrift*, Year 30, No. 48, pp. 777-779. Berlin, November 26, 1914.

Natural tuberculosis in donkeys has hitherto been observed three times in France (by BLANC, NOCARD and CESARI) and once in Germany. It is of very rare occurrence. In the case described by CESARI, the disease took the form of intestinal tuberculosis (affecting the Peyer's patches and the glands of the mesentery) and of metastatic miliary tuberculosis of the lungs, liver, kidneys and spleen; while the old donkey examined by BLANC showed signs of a tuberculosis of the lungs characterised by the presence of large nodular tubercles.

The tuberculosis of the donkey is clearly to be distinguished from that affecting other domestic animals, and especially the horse, because the donkey can withstand the disease to a very great extent although it cannot entirely resist it. This is shown by the very few cases of spontaneous tuberculosis that have been observed in donkeys, and also by the fact that, according to GALTIER, out of eleven donkeys which had been subjected to intravenous inoculation, only eight died; the remaining three lived, although suffering from calcification of the nodules. Further, STOCKMANN reports that out of three donkeys and one mule which had been infected by means of intravenous inoculation, only one donkey succumbed to general tuberculosis, the other animals resisting the disease.

JOHNE, ARLOING and NOCARD have carried out successfully other infection experiments which demonstrate that the donkey is not entirely resistant to tuberculosis.

399 - **Immunisation Tests with Glanders Vaccine.** — MOHLER, JOHN R., and EICHHORN, A. (Pathological Division, Bureau of Animal Industry) in *Bulletin of the U. S. Department of Agriculture, Contribution from the Bureau of Animal Industry*, No. 70, pp. 1-13. Washington, D. C., April 1914

Various attempts have been made to obtain immunity in horses against glanders, but without success. These experiments carried out by the Bureau of Animal Industry were designed to test the value of a vaccine consisting of a suspension of dried glanders bacilli prepared in the laboratory of the New York City Board of Health. The experiments were made on guinea-pigs and horses and in the latter case the blood was subjected to agglutination and complement-fixation tests.

The results obtained show that this method of immunisation is unsatisfactory. Of the 13 immunised animals, 9 contracted the disease from natural exposure. The vaccinated animals showed no resistance whatsoever to artificial infections and immediately developed acute symptoms of the disease. The control of glanders must therefore remain dependent upon the concentration of efforts to eliminate infected horses and the adoption of precautions against the introduction of infected animals into stables free from the disease.

400 – **Eradication of the Cattle Tick Necessary for Profitable Dairying.** — MC CLAIN, J. H. (Of the Dairy Division) in *U. S. Department of Agriculture, Farmers' Bulletin*, No. 639, 4 p. + 2 figs. Washington, December 1914.

The cattle tick is a great hindrance to the development of the cattle raising industry in the South. The ticks are the carriers of Texas fever, and even in so-called immune cattle they irritate the skin and draw blood that would otherwise produce milk or flesh. In order to ascertain the actual amount of harm done by ticks to these so-called immune cattle, the Department of Agriculture conducted some experiments on the effect of the tick on milk production and body weight of dairy cattle.

The work was done by the Bureau of Animal Industry in the summers of 1912 and 1913.

Forty cows were divided into two lots of 20, each of which was producing practically the same amount of milk and was given the same feed and care for an average of 152 days during the season favourable to the development of ticks. One of the lots in each experiment was allowed to become infested with ticks, while another was kept free from them, in one case by spraying and in the other by dipping. The main results of the experiments were as follows :

1. Cows carrying ticks did not hold up so well in milk flow as the cows kept free from ticks and did not increase their flow of milk when the feed was increased, as did the tick-free cows.

2. At the close of the experiment the cows lightly infested with ticks were producing 18.6 per cent less milk than the cows kept free from ticks, practically 1½ pints less per cow per day.

3. At the end of the experiment the cows heavily infested with ticks were producing 42.4 per cent less milk than the tick-free cows, or nearly one-half gallon less per head per day.

4. During the experimental period of one of the tests, which included 20 cows, the heavily infested cows lost an average of 9.3 pounds in weight, while the tick-free cows gained an average of 44.2 pounds, although the two lots were fed alike.

5. Cows which had previously been infested with ticks and were supposed to be immune suffered from tick fever and one cow actually died from the effects of the tick.

Some of the cows in the experiment were kept free from ticks by spraying with an arsenical solution and the others by dipping in a similar solution in a dipping vat. The spraying caused a temporary falling off of 6.1 per cent in milk, but in from three to five days the bad effects of the spraying disappeared. Likewise, the shock of dipping caused the cows to lose an average of 10.6 per cent in milk, for two days, but after several dippings they seemed to become accustomed to going through the vat and temporarily lost only 1 per cent in milk after the last few dippings. It should be remembered that these temporary losses due to dipping and spraying are very small, and it is by this means that the ticks are destroyed and a saving in milk effected in the long run.

These experiments were conducted with native cows on farms in the tick belt and are true indications of the great losses that occur annually with the thousands of cows exposed to the ravages of the cattle tick.

According to the results of the experiment a dairyman with 20 cows lightly infested with ticks would lose 30 quarts of milk per day, which at 5 cents a quart would amount to $1.50 for the entire herd each day. If the tick infestation were heavy the loss would amount to $3.40 a day.

The experience of a dairyman in the tick-infested territory confirms the above. Late in the season when his cows were covered with ticks they were dipped and the ticks killed. One week after dipping, the 42 cows in his herd gave 10 gallons of milk more than before dipping. This was an increase of 16.6 per cent, worth $3.50. The money which this dairyman spent in dipping his cows was a good investment.

401 – **Dipping Experiments in Connection with Sheep Blow-fli s.** — Cory, A. H., in *Queensland Agricultural Journal*, Vol. III, No. 1, pp. 15-17. Brisbane, January 1915.

Some experiments were carried out by the Department of Agriculture to test the effect of dipping sheep as a means of preventing losses from blow-flies. In April, 645 ewes were purchased, of which 10 lots of 50 were each dipped in a different kind of dip, the remaining 145 being used as controls. The season was exceedingly dry and no flies were seen till rain fell in June, and then only in a few cases which quickly recovered; towards the end of August, flies began to work amongst the sheep and in the middle of October they were carefully examined and their condition noted: Amongst the dipped sheep only 19 per cent were blown, while 54 per cent of the control sheep were attacked, so that it would appear from the season's results that dipping has a beneficial effect in diminishing the ravages caused by the blow-fly in sheep. The investigations are being continued.

402 — **The Relation to One Another and to the Skeleton of the Glands Forming Internal Secretions.** — DISSELHORST, in *Kühn-Archiv*, Vol. 5, pp 29-56. Berlin, 1914.

The writer gives a detailed account of the relation borne to one another and to the skeleton by the glands producing internal secretions. The most important are the thyroid, thymus, pituitary body, genital glands and pineal body. They are of great importance to the development of the different systems, and their removal may cause disturbances in the animal organism. The removal of the genital glands gives rise to the delayed ossification of the bones of the trunk and limbs, which is shown by the larger frame of the ox compared with that of the bull. The excision of the thyroid gland causes deficient skeletal growth and delayed ossification. The hypophysis, or pituitary body, is so far of importance to the growth of the skeleton, that its removal causes an early stoppage of growth, and decreases the sexual instinct, making the animal sterile. The excision of the thymus gland brings about a bad condition of nutrition of the body, although the appetite is greatly increased. The effect upon body growth exercised by the pineal gland has, according to the writer, not yet been closely investigated.

ANATOMY AND PHYSIOLOGY

403 — **The Behaviour of Certain Amino-Acids in the Metabolism of Birds.** — SZALÁGYI, K., and KRIWUSCHA, B. (Royal Hungarian Station of Animal Physiology, Budapest) in: I, *Kisérletügyi Közlemények*, Vol. XVII, Part 4, pp. 574-584 + 3 figs. Budapest, 1914. — II, *Biochemische Zeitschrift*, Vol. 66, Part 1-2-3, pp. 139-148. Berlin, 1914.

Experiments were conducted on ducks and fowls to determine: 1) the extent to which amino-acids occur in the excreta of these birds on a normal diet; 2) the effect of ingested amino-acids on the metabolism and on the composition of the excreta. The experiments were made with two drakes and two cocks, which had been provided with a second artificial anal opening so that the urine and excreta could be collected separately; the wounds had completely healed when the experiments were begun.

Maize was fed to all the birds as a basal ration at the rate of 50 gms. per bird per day. In the case of the drakes the increased amino-acid was obtained by feeding a ration of 48 gms. of maize and 2 gms. of asparagin during a certain period and 48 gms. of maize and 29 gms. of glycocol during another period. The cocks received 469 gms. of maize and 4 gms. of sugar-free molasses, containing 6.48 per cent total N and 0.8 per cent N as amino-acid.

The results showed that even with a diet consisting entirely of maize, both the urine and the faeces of ducks and fowls contain nitrogen in the form of amino-acid. The daily average of the two drakes was 10 mgms. of amino-acid nitrogen in the faeces and 18 mgms. in the urine (or 2.8 per cent of the total nitrogen excreted in the urine). The daily average of the two cocks was 21 mgms. in the urine and 13 mgms. in the faeces.

Asparagin fed to ducks is entirely absorbed by the alimentary canal, so that none appears in the excreta. In the case of glycocol, however, 4.84 per cent remained unabsorbed by one drake and 3.76 per cent by the other. With regard to the amide of molasses (betain-free), 0.03 per cent remained unabsorbed by the cocks. Most of the amino-acids absorbed are decomposed

n the organism of ducks and fowls, only very small quantities appearing n the urine. Thus the urine of one drake contained 3.77 per cent and that of the other 2.83 per cent of the asparagin absorbed, while for glycocol the igures were 6.50 and 4.75 for the two drakes; the amino-acids of molasses letermined by Van Slyke's method appeared in the urine of one cock to he extent of 6.9 per cent of the quantity absorbed.

404 - **The Rate of Liberation of Hydrocyanic Acid from Commercial Kinds of Linseed.** (1). — COLLINS, S. H., and BLAIR, H. (Proceedings of the Durham Philosophical Society, V, Part 4) in *The Chemical News*, Vol. III., No. 2876, pp. 19-20. London, January 8, 1915.

The amount of hydrocyanic acid contained and its rate of evolution have a bearing on the safety of linseed as a cattle food. Both are dependent on several conditions, of which the place of origin is the most important.

Analyses carried out during several years on samples from all parts of the world have shown that :

1. Seeds of oriental origin and from dry hot climates are all high in total hydrocyanic acid and rich in enzymic activity.

2. The average result of changing seed from dry hot climates to damp and cool conditions is to reduce the amount of hydrocyanic acid evolved by 20 ± 3 per cent and the rate of evolution by 24 ± 5 per cent.

Thus, it appears that seed grown in temperate climates is a safer cattle food than that from hotter climates. On the whole there is a tendency for seeds originating in temperate climates to give the best yield per acre and to contain the least proportions of cyanogenetic glucosides. It is proposed to continue the experiments with genetically pure seeds with a view to determining racial differences.

405 — **The Use of the Paunch Contents of Freshly Slaughtered Cattle as a Pig Feed.** — *Deutsche Landwirtschaftliche Presse*, Year XLII, No. 12. Berlin, February 19, 1915.

The German Minister of Agriculture has instructed the prefects to inform the slaughterhouse authorities in their districts that they are to supply pig owners with the paunch contents of slaughtered animals (as far as possible gratuitously) on request. For pig feeding 200 lbs. of the contents of the paunch should be added to 4 ½ gallons of blood, then mixed with 44 lbs. of molasses peat-moss, with 3 ½ lbs. of salt and a little whitewash. One part of this mixture has the feeding value of four parts of potatoes.

406 - **The Use of Mineral Phosphates in Calf Rearing.** — FAIRBAIRN, A. H., and HUTCHINSON, C., in *The Journal of the South-Eastern Agricultural College, Wye, Kent*, No. 22, pp. 170-174. London, and Ashford, Kent.

A rearing experiment was carried out with 14 calves which were fed for a period of 17 weeks. The diet at the start consisted entirely of new milk and this was gradually replaced by separated milk to which porridge made of linseed and maize meal, hay, concentrated food and roots were

(1) See also *B.* Jan. 1913, No. 48; *B.* Dec. 1913, No. 1352; *B.* June 1914, No. 543. [*Ed.*]

added as time went on. The calves were divided into two groups, to one of which precipitated calcium phosphate ($CaHPO_4$) was fed at the rate of 1 oz. per head per day. The average gain in weight per calf over the whole period was 141 lbs. for the phosphate-fed lot and 138 ½ lbs. for the control lot, from which it would appear that a common economical diet for store calves, such as was used in the above experiments, contains sufficient phosphate for the needs of the calves.

407 – **The Possibility of Adopting Starch Values in Practice and the Feeding of the Dairy Cow.** — SJOLLEMA, B. (Communication from the Chemical Laboratory of the Royal Veterinary College at Utrecht, Holland), in *Journal für Landwirtschaft*, Vol. 62, Part IV, pp. 345-375. Berlin, December 1914.

The writer proposes to investigate in what cases Kellner's starch-values are a measure that can be used, and especially if the starch-value (together with the digestible albuminoids) may be used for establishing the rations of dairy cattle.

As is well known, Kellner found, with fattening steers, that 1 kilogram of digestible food formed the following quantities of fat in the body:

1 kg of albuminoids	235	grams
1 » » fat	474–598	»
1 » » starch	248	»
1 » » cellulose	253	»
1 » » sugar	188	»

That is, that the ralative value for the formation of fat in albuminoids, fat and carbohydrates is as 0.94 : (1.91 - 2.41) : 1.

In the production of animal fat, 56.4 per cent of the potential energy (number of calories) of starch is fixed ; 64.4 per cent at most of the potential energy of fat ; 39 per cent of the total heat of combustion of the proteins, or 49 per cent of the difference between the total heat of combustion and that quantity that is given up to the organism (about 20 per cent).

As Kellner's data were obtained with fattening steers, the question arises, do they hold good for other animals (for instance non-ruminants) and for other forms of production? The starch-value represents the product of the content of digestible constituents, of the behaviour of these constituents as observed in the production of fat, and of their value. By changing one of these factors, the product changes also. From the discussion of these three points, the writer concludes that the proportional numbers used for the calculation of the starch-value lend themselves fairly well to the calculation of the maintenance ration of cattle, as well as of horses and pigs ; they remain also nearly the same when the form of production is work instead of fat. They do not, however, hold for the production of milk or of flesh (that is for growing animals), since in the production of milk more than 40 per cent of the proteids of the ration of production, and sometimes as much as 80 per cent (against 39 per cent in the production of fat) can be converted into milk protein ; while of the fats contained in

the ration of production, at most 1½ times the quantity converted in fattening animals (which is beyond 60 per cent) can be transformed into milk fat. For the production of meat the useful effect of proteins is about the same as for the production of milk.

From the discussion of the question as to the useful effect of the proteins contained in the ration on the production of the proteins of milk, the writer concludes that it is not right to attempt to represent the value of the ration of production of milch cattle by a single number, whether it be in starch-value or in milk-values (ORI A JENSEN). Such a single coefficient can exist only when a single substance (or work) has to be produced, and this substance (or work) may be produced by all the constituents of food, as in reality happens for the production of fat. For the same reasons it is not correct to express in starch-values the ration of production of young animals: in this case also the proteins have to perform a special duty (formation of flesh); on the other hand the useful effect of proteins is much greater in young animals than in the fattening of adult animals; therefore the proportional numbers of proteins, fat and starch are different.

In discussing the question of feeding milch cows, the writer is of opinion that the daily maintenance ration of the milch cow should contain at least 300 grams of digestible protein for every 500 kg. (1 100 lbs.) of live-weight: in Sweden the milk control associations calculate this quantity at 325 grams. In Denmark on the other hand much less is considered sufficient, namely from 100 to 125 gms. In Holland the figure is calculated at 270 to 300 gms. on the results of experiments carried out at Withuizermeeden (province of Groningen), and at 263 to 296 gms. from others made at the Hoorn experimental dairy. In the Hoorn experiments, during the winter 1912-13, the milch cows were fed a maintenance ration which for every 500 kg. live-weight contained a quantity of utilisable proteids calculated at 200 gms. on the basis of 75 per cent useful effect, and at 245 gms. on an 80 per cent basis. This ration had a sommewhat unfavorable effect on the live-weight of the animals and upon their milk yield, which diminished by 3.5 per cent.

The starch-value that must be contained in the maintenance ration of a milch-cow is calculated by Kellner at 5 lbs. per 1000 lbs. live-weight, while the above Dutch experiments set it at 6 lbs.

From the discussion of the question of the productive ration the writer concludes: The quantity of protein necessary to produce the unit of milk (*e. g.* 10 lbs.) can not be exactly determined; it is, however, not far from 0.4 lb., admitting that out of 100 parts of digestible protein in the ration, 80 parts are transformed into milk protein. For the formation of lactose probably 0.5 lb. of carbohydrate is necessary for 10 lbs. of milk, admitting that 90 parts out of 100 are converted into sugar. In practice, taking into account the individual differences, etc., it will be better to feed a little more protein and carbohydrate, that is 0.45 and 0.6 lb. respectively. Lastly, the milk fat will be formed as a rule partly from the fat and partly from the carbohydrates of the food. Assuming that for the

formation of the milk fat from these two groups of bodies the same quantitative rules as for the formation of the fat of the body hold good, then the production of all the fat of 10 lbs. of milk (containing 3.2 per cent) will require 0.55 lb. of fats or about 1.3 lbs. of carbohydrates contained in the wholly or almost wholly utilisable feed. If the fat in the milk is formed partly at the expense of the fat contained in the food and partly at the expense of the carbohydrates, *e. g.* 0.12 lb. from the former and 0.2 lb. from the latter, the ration will have to contain 0.2 lb. of fat and 0.8 lb. of carbohydrate. But it is not improbable that the useful effect of the fats contained in the food is higher for the production of milk fat than for the body fat, similarly to what takes place in the formation of milk proteins and lactose. Admitting that 0.18 lb. of fat in the fodder be available for the formation of the fat of 10 lbs. of milk and that the useful effect be 90 per cent, so that 0.162 lb. of milk fat will be produced, a further 0.158 of milk fat will be formed at the expense of the carbohydrates, of which 0.632 lb. will be required at the same rate of utilisation.

If it be allowed that the above data are not far from the truth, there still remain many unsettled points in the question of feeding, and a *sufficiently scientific basis for the calculation of the rations of milch cattle* is still wanting.

In establishing the rations of milch-cows which have nearly or quite finished growing, the writer considers that *provisionally* the following quantities may be accepted, taking into account individual conditions :

270 gms. (0.6 lb.) of proteins for the maintenance ration per 1 000 lbs. live-weight.
2 700 gms. (6 lbs.) of starch-value for the maintenance ration per 1 000 lbs. live-weight.
204.5 gms. (0.45 lb.) of proteins for the formation of the protein of 10 lbs. of milk.
270 gms. (0.6 lb.) of carbohydrates for the formation of the lactose in 10 lbs. of milk.

Besides the above, there are the carbohydrates and fats required for the production of milk fat. As useful effect (in the case of completely utilisable fodders) 25 per cent can be calculated for the former and 70 to 80 per cent for the latter.

BREEDING

408 – **The Abderhalden Dialysis Method for Determining Early Stages of Pregnancy Tested in Germany** (1). — RAELIGER, SIEBOLD and ROECKE, in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 8, pp. 88-99. Berlin, February 25, 1915.

The writers have tested Abderhalden's dialysis method on 52 subjects (47 cows and 5 horses). Strict attention was paid to the numerous communications made by Abderhalden and his fellow-workers, the test being carried out in such a manner as to exclude all possibility of error. The writers arrived at the conclusion that, though the possibility of obtaining correct results cannot be denied, it is questionable whether, at present, success can be achieved by the practical breeder, even if the directions are carried out with the most scrupulous care. Clinical methods will still retain the value they have always possessed.

(1) See also *B.* Jan. 1915, No. 69. (*Ed.*)

409 – **Substitutes for Oats in Feeding Farm Horses.** — *The Journal of the Board of Agriculture*, Vol. XXI, No. 9, pp. 808-811. London, December 1914.

Rations for farm horses. — During the winter months an ordinary farm horse should receive a daily ration of about 16 lbs of digestible food (organic matter), which should include about 1 ½ lb. of albuminoids. When the horse is on ordinary winter work rather more than half the total ration should come from grain and other concentrated feeding stuffs and rather less than half from hay and straw. In a ration of 14 lbs. of oats and 18 lbs. of hay the proportion would be 8 ½ lbs. of digestible food from the grain and 7 3/4 lbs. from the fodder. When the work is hard the grain ration should be increased so as to provide about 10 lbs. and when light about 6 lbs. of digestible food per day, the hay and straw rations being correspondingly reduced to give from 6 to 7 lbs. of digestible food in the former case, and increased to give about 9 lbs. in the latter. When employed on hard work, as much as 12 lbs. of digestible food may adavantageously be supplied as grain. Under normal market conditions, oats constitute an excellent concentrated food for horses and one of the most economical; but when prices are exceptionally high they may be profitably replaced by other feeding stuffs.

The following table gives the approximate weights of albuminoids in 14 lbs. of various feeding stuffs suitable for horses.

	Digestible organic matter	Digestible albuminoids
	lbs.	lbs.
Oats	8 1/2	1 1/4
Beans	10 1/4	3
Maize	11 1/4	1
Dried brewers' grains	7 3/4	1 3/4
Rice meal	8 1/4	3/4
Bran	8	1 1/4
Sharps	8	1 1/2

The eight rations given on the next page are based on the albuminoid content of the above-mentioned foods.

Rations for mares. — Mares in foal may either remain idle and at grass, or be at work and wintered indoors. In the former case the concentrated ration during winter may consist of about 3 lbs. dried grains, 3 lbs. rice meal and 1 lb. bran, the quantity of the last being increased to 2 lbs. before foaling. Mares which are worked during the winter months, in addition to an unlimited supply of hay may receive one or other of the following rations: 5 lbs. dried grains, 4 lbs. rice meal, 3 lbs. beans and 3 lbs. bran; or 5 lbs. crushed maize, 5 lbs. dried grains, 1 lb. beans, 1 lb. linseed cake and 2 lbs. bran. Each of these rations contains about 9 ½ lbs. of digestible food including 2 lbs. of digestible albuminoids. The bran should be increased to 3 or 4 lbs. just before and just after foaling, when mashes should be given.

	Oats Ration	Alternative Rations						
	1	2	3	4	5	6	7	8
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Oats	14	—	—	—	—	—	—	—
Crushed beans	—	2	4	—	3	—	3	—
Crushed maize	—	3	3	2	—	—	—	6
Dried brewers' grains	—	3	—	7	4	8	3	4
Rice meal	—	3	3	6	4	4	6	—
Bran	—	1	3	—	3	1	2	3
Sharps	—	2	—	—	—	2	—	—
Total	14	14	13	15	14	15	14	13
Containing:								
Total digestible food	$8\frac{1}{2}$	9	$8\frac{3}{4}$	9	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{3}{4}$
Digestible albuminoids	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}$
Cost	1s 2d	9d	$8\frac{3}{4}d$	$8\frac{3}{4}d$	$8\frac{3}{4}d$	$8\frac{3}{4}d$	$8\frac{1}{2}d$	$8\frac{1}{2}d$

Rations for young horses. — A foal may have a mixture of equal parts bruised oats, bran and crushed beans, starting with 1 lb. before weaning in the autumn, and rising to 3 lbs. daily when a year old. Colts from one to two years old may get from 3 to 5 lbs. daily of a mixture of equal parts of dried grains, rice meal, bran, and crushed beans. After two years old, until work begins, the colt's ration of concentrated food should rise to 7 or 8 lbs. daily. The last named quantity would contain $4\frac{3}{4}$ lbs. of digestible food, including 1 lb. of digestible albuminoids.

CATTLE

410 – **Zebu Crosses: Experiments Carried out at the Perugia Institute of Animal Husbandry** (1). — PUCCI, CARLO, in *L'Italia Agricola*, Year 52, No. 2, pp. 58-63. Piacenza, February 1915.

The writer describes the results obtained by him, which are also the first reported in Italy, by crossing Zebus with the Maremma, Romagnola and Perugia breeds.

The zebu bull belongs to the Gujerat breed, one of the most esteemed breeds of India; it is about $3\frac{1}{2}$ years old and weighs 1430 lbs. It combines an elegant shape with great robustness and remarkable agility. This bull served 113 cows between November 1912 and May 1914. Of this number only 9 remained sterile, or eight per cent (2); among them were some Schwyz and Dutch cows.

Naturally the observations made have been limited by the ages of the cross-bred animals, and the writer proposes to report later on subsequent

(1) See also *B.* May 1913, No. 545. (*Ed.*).

(2) These cows had already been tried in vain with other bulls.

investigations. Nevertheless he considers that the observations already made deserve a preliminary notice.

From an examination of the characters of the crosses obtained from the male Zebu with the Romagnola and Perugia females (3), as well as of those from the Schwyz and Dutch dams, which some farmers have bred out of curiosity, though they had been warned that the Gujerat cows produce only enough milk for their own calves, the writer has been able to collect the following data :

1. That in all the crosses the characters of the Zebu are dominant where the fineness of the skeleton, the abundance of dewlap, development of the ear, slope of the rump and muscular system are concerned.

2. That the coat-colour and size of horns seem recessive.

3. That in general all the crosses show remarkable agility in their movements and great robustness.

4. That they show much aptitude to produce flesh.

5. That they seem to possess considerable resistance to foot-and-mouth disease ; this resistance seems to be due to heredity, as would appear from observations made at the Gorio dairy near Brescia, where a male and a female Zebu of the Gujerat breed, which were kept together with a herd of 70 brown Alpine cows, were spared by the foot-and-mouth disease.

411 – **Significance of Milking Characters for Judging the Milk Yield of Cows.** — PETERS, J., in *Jahrbuch für wissenschaftliche und praktische Tierzucht*, Year 9, pp. 231-238. Hanover, 1914.

At the request of the East Prussian Dutch Herdbook Association, investigations were made to determine the value of milking characters in estimating the milking properties of cows. In accordance with the usual methods practised by the breeder, the whole complex of milking characters, together with the shape of the body, were determined once and represented by a figure.

A herd of about 140 cows was used ; all the animals were examined first on May 8 and again on November 8 of the same year ; the average of the two scores was taken as the estimate of the milking characters. Only such cows were taken into account as were at least 4 years old, had been controlled for at least 3 years and had had normal lactation during this period. They were divided according to the milking characters into three lots, the first containing those with the best charaters and the second and third those with moderate and lowest characters respectively. The three lots gave the following average milk yields per cow and year:

		lbs.
I.	Best milking characters	10 287
II.	Medinm » »	9 100
III.	Lowest » »	7 936

(3) The Maremma cows had not yet calved.

From these facts it appears that the breeder is on the right tack in taking the milking characters into consideration when selecting or purchasing cows.

412 – **Some Results from the Fattening of Dairy Cows.** — HUTCHINSON, C., in *The Journal of the South Eastern Agricultural College, Wye, Kent*, No. 22, pp. 161-169. London, and Ashford, Kent.

An investigation was made on the cost of fattening dairy cows, in order to determine the most profitable way of preparing them for the butcher. Five cows which were being drafted out of the milking herd were put on to a maintenance ration of :

40 lbs. swedes or mangolds
7 » meadow hay
14 » oat straw
2 » Egyptian cotton cake
1 » molascuit

to which was added a mixture of concentrated food stuffs at the rate of 4 lbs. of the mixture per gallon of milk produced. The experiment commenced on October 24th, 1912, when the cows were yielding from 11 to 20 lbs. of milk per head per day ; during the first period of the experiment, which lasted till December 19th (8 weeks), they received only the maintenance and milk production rations. Throughout the second period of eight weeks, the cows received an additional fattening ration of 6 lbs. of concentrated food per head per day, and during the third period, which lasted from February 13th till the cows were sold in March and April, the milk production ration was discontinued and the fattening ration was increased to 10 lbs. per head per day.

The gain in weight during the three periods was 122 lbs., 454 lbs. and 357 lbs. respectively, making a total of 933 lbs., while the estimated value of the total increase was £17 4*s* 3*d*, or 4 $^1/_2$*d* per lb. live-weight increase ; the milk yields during the three periods were 3 852 lbs., 3 807 lbs. and 895 lbs. respectively. Taking the value of the live-weight increase as 4 $^1/_2$*d* per lb. and that of milk at 8*d* per gallon, the returns for each period were worked out separately. The results show an excess of about £1 on the returns over the cost of food during the first two periods, while in the third period the cost of the food exceeded the returns by over £7.

The writer concludes that in preparing cows for the butcher, the fattening ration should be withheld from the diet so long as the milk yield has not fallen below an unprofitable level, and only introduced when required to arrest the normal decline of milk, as that part of the ration devoted to maintaining the milk flow gives better returns than that part utilised for body increase. Further, the results of the third period would suggest the advisability of curtailing the interval between drying off and sale as much as possible, and, unless there is a marked difference in value between a fat cow in milk and a similar cow out of milk, of selling the fat cows direct from the milking herd.

413 — **The Central Pyrenean Sheep.** — GIRARD, in *Revue vétérinaire*, Year 39 (71), Nos. 7, 8 and 9, pp. 402-410, 460-471, 523-536, 7 figs., 2 tables. Toulouse, July, August and September 1914. SHEEP

The breed of sheep of the Central Pyrenees, to which belong all the sheep of the mountainous districts of the departments of Haute-Garonne and Ariège, was for a long time included with the neighbouring breeds of the extremity of the chain (Basquaise, Béarnaise, Corbières and Roussillonnaise) under the generic name of "Mountain breed," or later "Pyrenean breed".

Nevertheless, from the most remote times, the Pyrenees in the neighbourhood of the Mediterranean district have been the home of a small Merino sheep with very fine wool, while the sheep of the Atlantic side are large animals with very long and coarse wool, and those of the central region are small and lively, with coarse, but not thick, wool, often mixed with hair. For the State regional shows the Agricultural Administration distinguishes in its schedule two Pyrenean breeds, the one with long wool and the other with curly wool. The sheep of the Central Pyrenees belong to the second group. At the last special regional competition held at Foix (May 1914) the Agricultural Administration recognised in its schedules only two sub-breeds of these sheep: 1) that of the high valleys of the Ariège (the old Tarascon or Ariégeoise properly so-called); 2) the Castillonaise or Pyrenean sub-breed with red points.

Sheep have always been of much greater importance than cattle in the Central Pyrenees. This district is one of the most important in France for sheep, at least as regards their number, which has been estimated at over 400 000. The present sheep of the Upper Ariège represent, according to the writers, the almost unchanged descendants of the breed existing throughout the plateau of the Pyrenees, in both France and Spain, long before the Iberian invasion and the Roman conquest. Certainly it is the oldest of all the breeds acclimatised in the Pyrenees district. It has been able to resist the transforming effect of crossings, in spite of the invasion of Merinos at the end of the eighteenth century, the importation of Flemish rams in 1792 and the introduction, about 1860, of numerous rams of improved English breeds (Leicester, Kent, Southdown and their crosses).

The sheep of the Central Pyrenees are quite distinct from the other French breeds. They are general purpose animals. The height of the largest rams never exceeds 33 inches, while that of the smallest ewes is never below 20 inches; the weight of an adult animal in store condition is between 85 and 180 lbs. In colour they are usually white, with head and legs striped or spotted with russet, brown or black; occasionally they are entirely of one of these colours. The wool is of moderate length (about 8 in.), and decidedly curled; the staples are rather coarse and run to a point; there is frequently a large proportion of hair.

The breed is very hardy and the only one suited to this wild country. It is considered resistant to liver-rot, which decimates all the other breeds of the damp districts of the upper basin of the Garonne, and is very adaptable to the most varied climates and conditions. The rams have great pre-

potency, so that they are most useful in improving the milking breeds of the South of France which have been weakened by in-breeding or other causes. Many Central Pyrenean sheep are sold to improve the milk-yielding properties of the flocks in the Rocquefort cheese-making districts. They fatten quickly, even when grazing on the mountains, provided the pastures are not too heavily stocked; in the plain, where they are more liberally and regularly fed, they develop early and make excellent carcases. When properly fed on roots and grain with a little cake, they fatten well. They are not ready for the butcher until 3½ or 4 years; the mutton is excellent. Their wool production is also average, the fleece weighing from 4½ to 9 lbs. The wool is strong and tough; it is used for the manufacture of coarse cloth and especially for mattresses.

For some time, owing to systematic selection, which is encouraged by the State, the Departments and the local Agricultural Societies, the Pyrenean sheep have greatly improved in uniformity and are in process of forming a single distinct type. Two sub-breeds are officially recognised, with russet and coal-black extremities respectively. Those of the black-faced type are more nearly related to the large Pyrenean breed; this type is the more numerous, the older and the more widely spread; the russet is less numerous, but is superior in quality.

414 — **The Short Eared-Sheep of Norway**. — WRIEDT, CHR., in *Jahrbuch für wissenschaftliche und praktishe Tierzucht*, Year 9, pp. 266-267. Hanover, 1914.

In many districts in Norway amongst the old short-tailed type of sheep occasional animals are found which have also very short ears. The writer has met with five such sheep and has been able to study four of them more closely. The first had an ear length of 4 cm. (1 ½ in.); it was white, and rather like a Cheviot; when mated with a pure Oxford Down ram, it gave birth to a distinctly short-eared lamb. The other three sheep belonged to a small farmer's flock of ten, and were descended from a ewe which had been purchased twenty years previously. During all this time, it had never occurred that a ewe with normal ears had produced short-eared offspring; thus the possession of short ears appears to be a dominant Mendelian character. These three short-eared animals were a ewe and its twin lambs; the ears of the mother and the ewe lamb were 4 cm. (1 ½ in.) long and those of the ram lamb 5 cm. (2 in.), while the normal length of the ears of Cheviot hybrids is 8 or 9 cm. (3 to 3½ in.). None of the other seven sheep of the flock had ears of intermediate length.

PIGS

415 – **Rations for Pigs.** — *The Journal of the Board of Agriculture*, Vol. XXI, No. 8, pp. 730-731. London, 1914.

When, owing to the abnormal conditions of the market, a number of feeding stuffs which are commonly used for pig feeding are scarce and dear while others are relatively cheap, it may be useful to suggest some rations of equal feeding value to those generally used but more economical. Such are the rations given below. In each case No. 1 represents the ration in general use, while the others are the alternative ones. The cost is based on the prices ruling in London in October 1914.

Rations for Fattening Pigs.

For pigs of 40 lbs. live weight.

Ration 1		Ration 2		Ration 3	
1 lb. Middlings 1/2 » Barley Meal.	1 1/5d	1/2 lb. Middlings 1/2 » Gluten Meal. 1/2 » Rice Meal	1d	1 lb. Sharps 1/2 » Middlings 1/8 » Fish Meal	1d

For pigs of 80 lbs. live weight.

1 1/2 lb. Sharps 1 1/2 » Barley Meal	2 1/4d	3/4 lb. Sharps 3/4 lb. Bran 3/4 » Gluten Meal 3/4 » Rice Meal	1 3/4d	1 1/4 lb. Sharps 1 1/4 » Middlings 1/4 » Fish Meal	1 4/5d

For pigs of 140 lbs. live weight.

2 lb. Sharps 2 » Barley Meal 1/2 » Maize Meal	3 2/5d	1 1/2 lb. Sharps 3/4 » Bran 3/4 » Gluten Meal. 1 1/2 » Rice Meal.	2 1/2d	1 1/4 lb. Sharps. 1 1/4 » Middlings 1 1/4 » Rice Meal 1/2 » Fish Meal	2 3/4d

For pigs of 180 lbs. live weight.

2 1/2 lb. Sharps 2 1/2 » Barley Meal 1 » Maize Meal	4 2/3d	2 lb. Sharps 1 » Bran 1 » Gluten Meal 2 » Rice Meal	3 2/5d

Rations for Sows suckling their Young.

4 lb. Sharps 4 » Middlings 2 » Bran	6d	4 lb. Sharps 3 » Middlings. 2 » Bran 1/2 » Fish Meal	5 9/10d	4 lb. Sharps 2 » Bran 4 » Rice Meal	5 2/5d

The above quantities suppose that only such foods are fed, but it will be very advantageous to supply some green food also. Young store pigs may be allowed to run out to graze, while fattening pigs must be given some green forage such as clover, vetches, lucerne and rape, or potatoes, turnips and mangolds. The three last mentioned should be boiled before being fed. The results of numerous experiments show that about 4 lbs. of potatoes or 8 lbs. of turnips or mangolds may replace about 1 lb. of cereal meal in a mixed ration. Lucerne, clover and rape, lb. for lb., are even more valuable than potatoes when fed in conjunction with cereal meals or offals. Similarly skimmed milk or buttermilk are most useful additions, particularly for young pigs. It is calculated that 1 gal. of skim milk is equal to

1 2/3 lb. of cereal meals. When procurable at 1*d* to 1 ½ *d* a gallon skim milk or buttermilk can generally be profitably fed in quantities up to 1 gal. per head daily.

BEES

416 – **Inheritance in the Honey Bee.** — NEWELL, WILMON, in *Science*, Vol. XLI, No. 1049, pp. 218-219. Garrison, N. Y., February 15, 1915.

Reciprocal crosses were made between the Italian and Carniolan races of bees ; the former are distinctly yellow in colour while the latter are more or less gray and possess the further characteristics of using wax instead of propolis for sealing crevices, fastening frames together, etc. Italian queens mated to Carniolan drones produced an F_1 generation of workers and queens in which the yellow colour and the abnormal use of wax were dominant, while in the same generation resulting from the reciprocal cross, dominance of neither character was absolutely complete. Italian queens mated to Carniolan drones produced only Italian drones, and Carniolan queens mated to Italian drones produced only Carniolan drones, but F_1 queens of either cross produced Italian and Carniolan drones in equal numbers. Assuming that the drone is produced parthenogenetically, yellow colour behaves as a simple Mendelian character ; the practice of professional queen-breeders of considering that an Italian queen has been purely mated if she gives rise to yellow workers would therefore be incorrect.

FISH BREEDING

417 — **Experiments in Controlling the Musquash by Bacteria** (1). — BROZ, OTTO, in *Österreichische Fischerei-Zeitung*, Year 12, No. 4, pp. 26-27. Vienna, February 15, 1915.

At the request of the Ministry of Agriculture, the Austrian Plant Protection Station in Vienna has investigated the possibility of using the bacterial cultures kept for the destruction of mice and rats (*Bact. typhi murium*. Löffler, and Danysz virus) in the control of the musquash (*Fiber zibethicus* Cuv.). This animal, which was introduced some years ago into Austria (Bohemia), has increased so greatly as to have become a real pest to the fisheries.

The infection tests were carried out by administering the bacteria to the subjects of the experiment, either with wheat and fish, or with maize and wheat. One rat was given the Löffler mouse-typhus bacterium, another the Danysz, and a third a mixture of the two species. All three treatments gave infection, followed by death. As the experiments have been successful, they will be continued.

418 – **Unit Production of a Trout Pond.** — RAVARET-WATTEL, C., in *Bulletin de la Société Nationale d'Acclimatation de France*, Year 62, No. 2, pp. 45-47. Paris, February 1915.

As a contribution to the solution of the important practical question of the quantity of fish that can be reared per surface unit of a pond, so as to obtain tha largest profit possible without having recourse to artificial feeding, the writer gives an account of the following experiments carried out in Switzerland, of which the results correspond to the figures obtained on other occasions.

(1) See also *B.* Feb. 1915, No. 242. (*Ed.*).

In a pond of 12 sq. yds. area, fed by a small stream (which only ran at the rate of about a gallon per minute), were placed in April, 15 young fry of different Salmonidae, *viz.* :

5 common trout, of 5 gms.,	total weight	25 gms.
5 rainbow-trout, of 3 to 5 gms.,	» »	17.5 »
5 brook-trout, of 6 gms.,	» »	30.0 »
	Total . .	72.5 gms.

The bottom of the basin was covered with a layer of puddled clay $^3/_4$ in. thick. During the winter, manure had been spread all round, in order to prevent the water freezing at the edges ; some of it fell into the basin, so that in the spring the water, which was 2 ft. deep, presented a very noticeable yellowish colour. At the bottom and on the surface grew many algae, as well as *Lemna minor*, *Potamogeton densus* and *P. crispus* ; many minute crustaceans (*Cypris*, *Cyclops*, *Daphnia*), molluscs (*Limnaea*) and larvae of *Ephemera* were present. The clay at the bottom also harboured many larvae of *Chironomus plumosus*, while the sides of the pond were covered with a thick layer of algae. During the summer heat, the temperature of the water easily reached 22 to 23° C. (72 to 74° F.), which was most favourable for the development of the lower flora and fauna forming the sole food of the young fry.

After three months the fish were caught and it was found that the common trout and brook-trout had grown the most. The rainbow-trout, in spite of the relatively high temperature of the water, which should have been favourable to their development, took the third place. This removal of the fish from the water caused the death of two common trout, whose combined weight was 88 gms.

On October 24, the fish were all taken out, and their weights were as follows :

5 brook-trout,	total weight	201 gms.
5 rainbow-trout,	»	181 »
3 common trout,	»	137 »
	Total . . .	519 gms.

Adding to this the weight of the trout that perished from the first fishing, the total amounts to 607 gms. (1 lb. 5 oz.), and subtracting from this the initial weight of the fry, we have 534.5 gms. (1 lb. 3 oz.), which represents the gain in weight during the six months ; this corresponds to just over 1 $^1/_2$ oz. per sq. yd. Thus, an acre might give 450 lbs. of trout, without any expense for food.

419 — **Rearing Large Quantities of Daphnids as Food for Salmonid Fry.** — WOHLGEMUTH, R., in *Allgemeine Fischerei-Zeitung*, Year 40, No. 5, pp. 69-71. Munich, March 1, 1915.

Although it has been pointed out already by various observers, that it is possible to feed Salmonid fry upon Daphnids, during the early stages of their development, the practice of rearing large numbers of these in small

ponds has hitherto found little favour. The principal reason for this fact is, that it is impossible to rear Daphnids in the open, during the winter, *viz.* from January to March, in ponds which are cold and exposed to the wind, for they only breed successfully in water that has been well warmed. Thus it is necessary to do without this food for young fry just at the time when it is most wanted, *i. e.* from January to March, the breeding-season of trout and brook-trout.

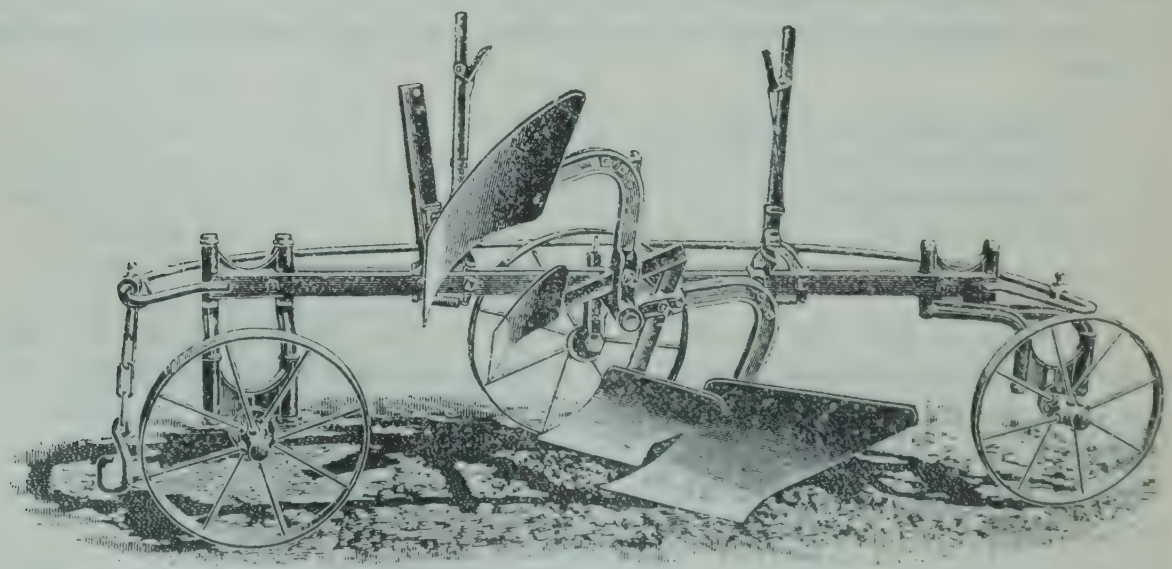
A cause of lack of success in summer may be the entrance of cold spring-water at the bottom of the pond : arrangements should be made to prevent this. Further, the choice of the right kind of Daphnids is a great element of success ; if the animals are taken from a clear stream or pond, or even from a lake, when introduced into their new quarters, they often breed but sparingly, or very soon die out. If, on the other hand, they are collected from village ponds, or from puddles, better results are usually obtained. This circumstance, which was experimentally demonstrated by the writer, is due to the fact that Daphnids from clear streams require much more oxygen than the pond dwellers. According to the writer, the species requiring little oxygen are *Daphnia magna*, *D. pulex* and *Moina rectirostris*.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

420 – **Falkenburger's Automatic Balance Plough.** — *Maschinen-Zeitung*, Year 13, No. 2, p. 6. Berlin, January 15, 1915.

The accompanying figure shows Falkenburger's automatic balance plough, patented in Germany under No. 274 139. In this plough the oppo-



Falkenburger's Automatic Balance Plough.

site shares are attached to a shaft fixed across the centre of the beam, which is carried by three wheels. When ploughing, the share at work is kept in

position by a spring controlled by a lever. On nearing the end of the furrow the lever at the rear is drawn back and the resistance of the soil causes the corresponding share to lift out of the ground and the other one to descend ready to open the new furrow as soon as the direction of the plough is reversed. Thus the machine does not require to be turned; only the team, without unhitching it, is led round, while the draught chain runs on a rod parallel to the beam. By the ingenious device of an articulated parallelogram the plough moves automatically sideways into the new furrow.

The chief advantages of this plough are the following: owing to the support given by the three wheels and to the central position of the shares, it requires practically no steering; it is easy to remove from place to place, as, when travelling, the shares can be fixed in a position well clear of the ground; lastly the very fatiguing work of changing the position of the shares in the usual turnwrest ploughs, at the end of every furrow, is completely avoided, so that even a mere boy can use this plough.

421 – **Disk Plough with Second Shaft Bearing Blades which Break up the Slice.** — *Maschinen-Zeitung*, Year 12, No. 23, pp. 245-246. Berlin, December 1, 1914.

The main features of this machine, patented in Germany under No. 276 086, are a number of sharp disks, mounted near each other on the same shaft, which cut into the soil by the weight of the whole machine and

Action of special disk plough.

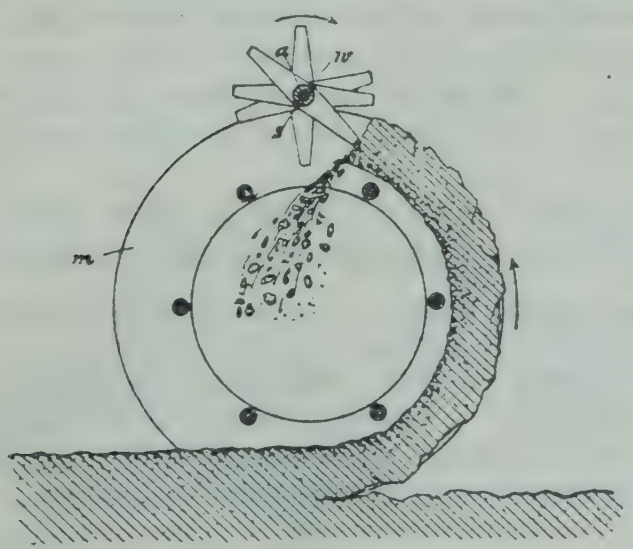


Fig. 1.

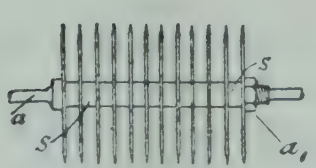


Fig. 2.

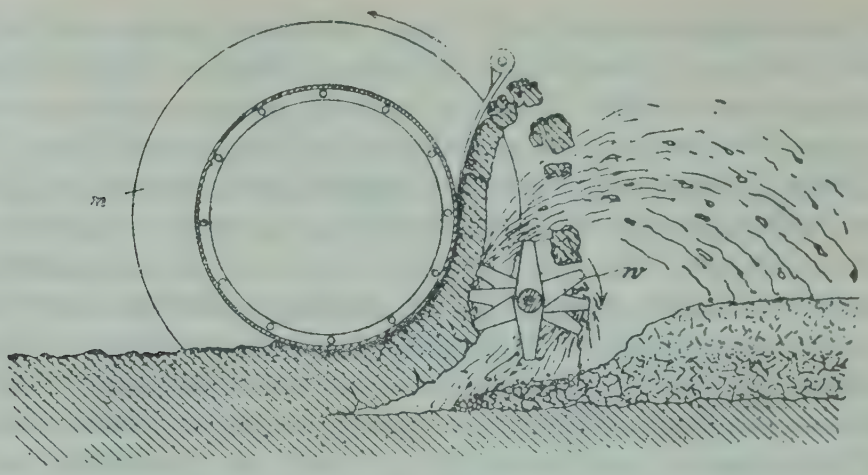


Fig. 3.

lift by friction a slice of earth which is then broken up by a series of knives mounted on a second shaft which may be situated over or behind the disks. In order to prevent the rapidly revolving knives being injured by stones or the like they are not rigidly attached to the shaft but are mounted in such a way as to allow relative motion between them.

Besides, they may be arranged in such a way to the lifted slice that only the outside of the latter is broken up and thrown backwards while the inner portion is scraped off and allowed to fall on the revolving knives which break it up and throw it into the bottom of the furrow. Figs. 1 and 3 are cross sections of the working parts of the machine and fig. 2 is an elevation of the knives mounted on a shaft *a* and kept at the proper distances from each other by rings *s*. A nut *a'* presses them all tightly together, but it allows some freedom to each blade when the resistance exceeds a certain limit.

In fig. 1 the blades are placed over the disks and in fig. 3 they are situated behind ; with this arrangement the soil is completely turned over.

422 – **Tillering Wheat by Ma hinery.** — *The Implement and Machinery Review*, Vol. 40, No. 479, pp. 1384-1385. London, March 1, 1915.

The Rev. E. SEELEY of Tunbridge Wells, England, has invented an agricultural machine, the " Tillerer " which, it is claimed, assists wheat plants to tiller, that is to make more stems above ground and more roots beneath than would grow naturally without assistance.

The tillerer, in the main, is a drilling machine, but provided with thee different sets of tilling implements.

The first set consists of small moulders which are placed in front of the seeding apparatus and which make small furrows in the bottom of which the seed falls at wider intervals than usual, namely 3 to 4 inches apart — thus effecting a saving of seed, using only half a bushel per acre against the usual two to two and a half bushels. — As the machine moves on some soil falls in and covers the seeds sufficiently.

When the plants show three to five inches of the third blade the seeding coulters and the moulders are removed from the machine and a set of

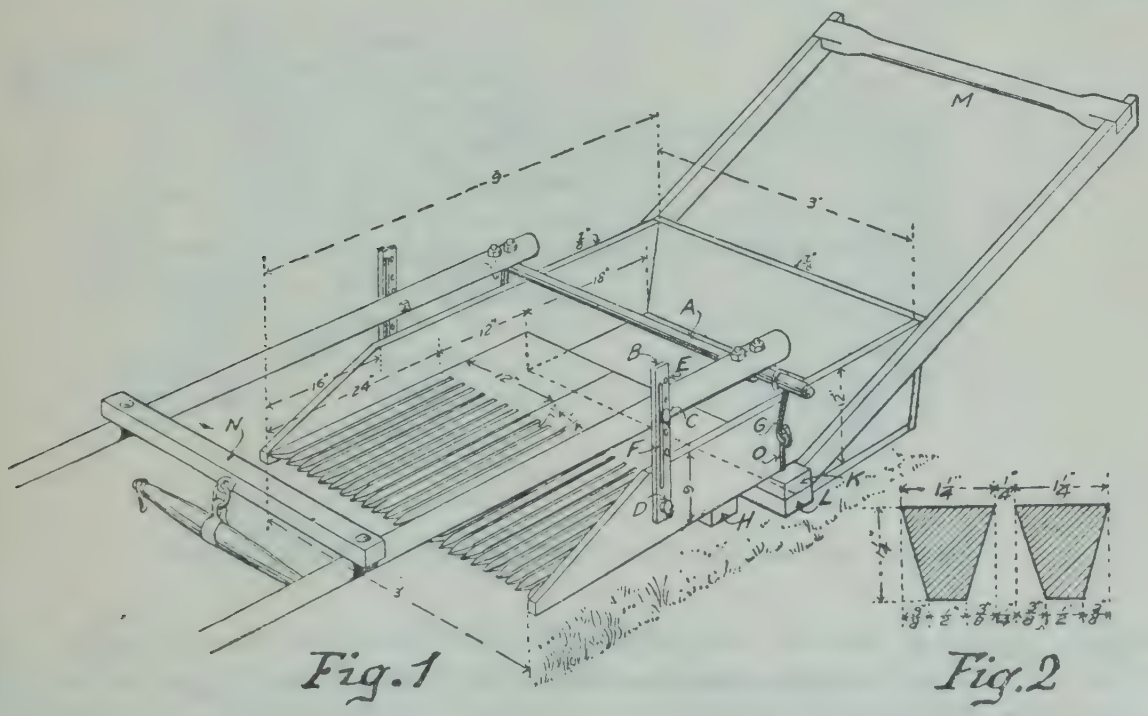
two-lined curved forks substituted and placed with the points turned towards the back of the machine. The tillerer is then driven along the rows with the forks pressing on the ridges and scattering part of their soil into the furrows on the roots of the little plants.

When another three or four blades have grown, the first set of forks is exchanged for the next set. These are three-tined forks and resemble a bird's foot. These are used similarly to the first set but with rather more pressure. They bring the soil of the ridges down to the old level of the ground, filling up the furrows.

The time for the fourth stage is a matter of discretion. The forks are removed and the moulders without the seeding coulters are replaced. The machine is drawn over the field so that the moulders pass half way between the rows of plants, with just enough pressure to make slight furrows. This leaves the plants earthed up in little ridges 1 or 2 inches higher than the old level of the ground, and gives the plants plenty of space for artificially developed roots 3 inches or more above the original seed.

423 – **An Inexpensive and Efficient Stripper for Crimson Clover.** — *The Country Gentleman*, Vol. LXXX, No. 7, p. 281. Philadelphia, February 13, 1915.

This crimson clover seed stripper is designed to be hung on the axle *A* between two wheels which are not shown in the accompanying fig. 1. The iron hooks *G* are used to attach the stripper to the axle, and should be of



Clover stripper.

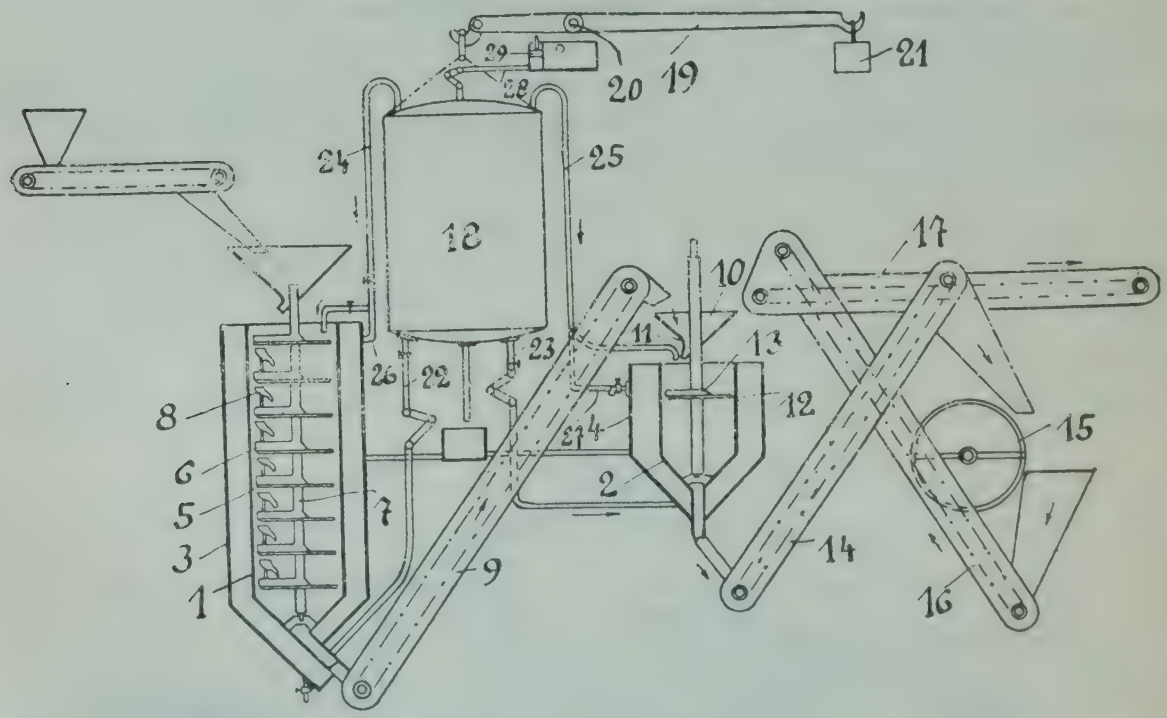
such length as to allow the bottom of the stripper to ride at six inches from the ground. The handle *M* permits the teeth to be raised or lowered to catch the heads at the proper height. The limits through which the teeth may be raised or lowered are fixed by means of the slot *F*. This prevents

either the front or the back of the machine from tilting enough to strike the ground. When it is desired to hold the stripper rigid, the removable bolt *C* can be taken out and inserted in one of the holes *E*.

It is necessary to have the plank *N*, to which the whipple-tree is attached, fastened to the shafts far enough in front to prevent the horse's hoofs from coming in contact with the teeth of the stripper. The teeth are sawed out of oak boards, which in turn are nailed to planks *H* and *K*. Fig. 2 shows the cross section through the teeth.

424 – **Boltze's Patent Apparatus for the Control of Smut in Spring Cereals.** — *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 98, p. 1017. Berlin, December 9, 1914.

For the control of smut in spring cereals a warm water bath followed by drying is used. Boltze's apparatus, patented in Germany under No. 279 329, has been devised for this purpose. In the annexed figure, 1 and 2 show the vats in which the grain is treated; they are fitted with



Boltze's Apparatus for the Control of Smut in Spring Cereals.

jackets, 3 and 4, and are all supplied with hot water or steam by the boiler 18. This is suspended from the oscillating beam 19, supported in its turn by the pivot 20 and balanced by the counterweight 21. When the water diminishes in the boiler it becomes lighter and rises; a feed valve then opens and the automatic feed pump 29 injects water into the boiler. On sinking, the feed valve closes. Some of the pipes, 22 to 27, lead hot water and others steam to the vats or their jackets.

The boiler is heated by electricity or by gas; in either case the temperature is regulated by a thermostat. Inside the vats, agitators are situ-

ated; they consist of a certain number of fixed plates, 5, and scrapers, 6, worked by a shaft, 7, which drive the grain from one plate to the next lower one, and at last to the elevator 9 and into vat 2, whence it falls into elevator 14 which conveys it to a ventilator, 15. There it is freed from the water adhering to it and cooled. The third elevator, 16, shoots it onto a conveyor, 17, which carries it to a drier or to the store room.

425 – **Review of Patents.**

Tillage machines and implements.

Austria
68 306. Ploughshare with removable blade.
68 400. Device for two-engine ploughings.

Canada
158 724. Weed destroyer.
158 871. Rotary plough.
159 027. Harrow ploughs.
159 047. Harrow.
159 200. Plough.

Switzerland
68 284. Appliance for hoeing and removing turf.

United States
1 122 269. Subsoil attachment for ploughs.
1 122 368. Ploughing and pulverizing machine.
1 122 370. Wheeled cultivator.
1 122 461. Rotary plough.
1 122 837 — 1 122 899 — 1 123 761 — 1 124 183 — 1 124 845. Cultivators.
1 123 280 — 1 123 618 — 1 123 922 — 1 124 292 — 1 124 344 — 1 125 165 — 1 125 206 — 1 126 632. Ploughs.
1 123 535. Coulter for ploughs.
1 123 699. Cotton chopper.
1 123 748. Motor plough.
1 123 991. Traction plough.
1 124 004. Gang plough.
1 124 106. Shovel for cultivator.
1 124 534. Quack grass digger.
1 124 162. Power-propelled cultivator.
1 124 703. Disk harrow attachment.
1 124 848. Draught attachment for harrows.
1 124 558. Ploughing machine.
1 125 021. Combined plough and fertilizer distributor.
1 125 808. Harrow.
1 125 409. Revolving harrow.
1 125 514. Disk harrow.
1 126 118. Disk marker.
1 126 603. Reversible plough.

Manure distributors, etc.

Cuba
2 195. Improvement in artificial manure spreader.

Germany
280 934. Manure distributor with travelling distributing drum provided with adjustable slits.

United States
1 123 834. Manure spreader.
1 125 122. Combined manure loader and spreader.

Drills and sowing machines.

Austria
68 343 — 68 364. Potato planters.

Germany
281 368. Potato planter with screw distributor.

United Kingdom 21 808. Potato planter.
United States 1 124 243. Single-disk drill.
1 124 523. Seed planting device.
1 124 616. Combined seeder and guano distributor.
1 124 695. Grain drill.
1 126 393 — 1 126 647. Corn planters.

Reapers, mowers and other harvesting machines.

Austria 68 362. Machine for collecting and binding cereals.
Denmark 19 752. Improvement in binders.
Germany 280 953. Swathe rake.
280 986. Mower cutter-bar without fingers.
280 987. Mower cutter-bar with special guide bar.
281 308. Device for raising or lowering the frame of mowers on the driving wheel.
Italy 145 295. Sharpener for mower-blades.
United Kingdom 23 374. Side-delivery rake.
United States 1 122 798. Seed stripper and harvester.
1 122 203. Kafir-corn harvester.
1 122 741. Cane harvester.
1 123 949. Reel-arm attachment for harvesters and the like.
1 123 601. Cotton picker.
1 124 059 — 1 125 026. Bean harvesters.
1 124 499. Hay tedder attachment for mowers.
1 126 600. Shocking machine.
1 124 236 — 1 124 416. Grain-shocking machines.

Machines for lifting root crops.

Austria 68 656. Beet-topping machine.
Canada 158 992. Beet harvester.
Denmark 19 733 — 19 798. Root-lifting machines.
19 835. Beet lifter.
19 839. Collecting box for beet lifter.
19 851. Machine for lifting and topping roots.
Germany 280 936. Device for potato lifters with revolving throw forks.
Netherlands 513. Root-lifting machine.
United States 1 122 761 — 1 123 897. Beet harvesters.
1 124 406. Beet puller, topper and loader.
1 124 414 — 1 125 390. Potato diggers.

Threshing and winnowing machines.

Germany 280 755. Sheaf elevator with automatic discharge.
United States 1 122 765. Seed-cleaning machine.
1 122 958. Feeding device for threshing machines.
1 123 028. Self-feeder for threshing machines.
1 124 274. Sheaf loader.
1 125 603. Seed grader.

Machines and implements for the preparation and storage of grain and fodder.

Canada 158 713. Tally for grain hoppers.
159 094. Hay press.
Germany 280 756. Straw press with automatic gearing for the binder.
280 757. Beet slicer with automatic device for removing the slices.

laboratories in different localities, was founded. The number of branches was increased to six in 1912-13. The experimental sections of the two Institutes of Sericulture have been united into a National Laboratory. In 1912 a Central Commission entrusted with enquiries and studies on the selection of silkworms began its labours.

Agricultural experimentation. — The Government has founded a National Agricultural Experiment Station at Tokyo, with branches at Kyushu, Kinaï (Central provinces) and in the Riku-U (North-East provinces). Researches on soil, fertilisers, seeds, vegetable pathology, agricultural machines and implements, animal husbandry, agricultural industries, selection, market gardening, etc., are conducted there. The Government also gives grants in aid to the Experiment Stations which exist in almost all the departments. Both in the former and in the latter, experiments on the growing and on the preparation of the leaf have been carried out and are being continued.

345 – **Ducks as a Preventive of Malaria and Yellow Fever.** — DIXON, SAM. G., in *Bulletin de l'Office International d'Hygiène publique*, Vol. VI, Part 12, pp. 2083-2084. Paris, December 1914. RURAL HYGIENE

Ducks, which occur in all regions of the globe, are among the greatest enemies of mosquitos, and consequently of yellow fever and malaria. Their value in this respect has been determined as follows : By means of dams two pools of equal area were made in a stream. Ducks were placed in one and fish in the other. The former was speedily cleared of mosquitos whilst the second continued to maintain the insects in all stages of development. Wild ducks were then introduced and found to prefer the insects to all other foods. At the end of 24 hours no pupae were found in the pond and after two days all the larvae had been destroyed. These experiments confirm the observations of WILLIAM LOCKWOOD, who found that the duck was particularly adapted to devouring the larvae on the surface of water, and of MC ATEE, who found mosquitos in the gizzard of a wild duck.

The mosquito has numerous animal enemies, of which the duck is the most widespread and consequently the most suitable to clean up unhealthy marshy districts which it would be too costly to drain.

CROPS AND CULTIVATION.

346 – **A New Chemical Hygrometer.** — RIDEAL, E. K., and HANNAH, A., in *The Analyst*, Vol. XL, No. 467, pp. 48-54. London, February 1915. AGRICULTURAL METEOROLOGY

The method of measuring the relative humidity of the air by the wet and dry bulb thermometers is liable to give inaccurate results under certain conditions, and for this reason investigations have been led to the subject of chemical hygrometry. The present paper describes a simple apparatus for determining the moisture content of the air by volume measurements before and after contact with sulphuric acid, which completely absorbs all water vapour present in one contact; the manipulation

is easy and less than two minutes are sufficient to obtain a reading. In a series of trials carried out over a period of several months, the hygrometer worked most satisfactorily and gave results in very good agreement with those obtained by gravimetric determinations and by the use of Regnaults's dew-point apparatus, while readings taken simultaneously with wet and dry bulb thermometers sometimes showed wide discrepancies.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

347 – **The Formation of Humus by means of Vegetable Compounds.** — TROUSSOFF, A., in *Selskoie Khoziaistvo i Lesovodstvo* (*Economie Agricole et Sylviculture*), Year LXXIV, No 246, pp. 233-246. Petrograd, October 1914.

With a view to resolving the problem of the process of formation and the chemical composition of the different types of humus, each consisting of its own combination of component substances which may be identical in each case but present in varying proportions, the writer investigated the substances which give rise to the formation of humus. Laboratory experiments gave the following results.

Concentrated and dilute (20 %) *sulphuric acid* (12 hrs. on water-bath) produced humus from *glucose, levulose, saccharose, dextrines* and *starch*; from *cellulose* the concentrated acid produced it on boiling for ½ hr., but the dilute acid failed by either method.

Concentrated hydrochloric acid (12 hrs. on water-bath) gave humus with both *glucose* and *levulose*, and the 20 per cent acid (same conditions) with *glucose*.

Concentrated nitric acid (½ hr. boiling) failed to give humus with *levulose*, but the *dilute* (20 %) *acid* (12 hrs. on water-bath) gave humus with *glucose, levulose* and *dextrines*.

Concentrated acetic acid (12 hrs. water-bath) gave humus with *glucose* and *levulose*, and *dilute* (20 %) *acid* (same conditions) also gave it with *levulose*; the *concentrated acid* failed to yield it with *dextrines* by either method.

Caustic soda (75 per cent) gave humus from both *glucose* and *levulose* on treatment on water-bath for 24 hrs. and from *dextrines* when boiled for 24 hrs.

Sodium acetate (0.5 per cent) failed to produce humus from either *glucose* or *levulose* after 6 days on the water-bath.

Potassium permanganate (0.1 per cent, 2 days), *chromic acid* (25 per cent, 2 days), *oxygenated water* (conc., 6 days) and *water* (6 days) all failed to produce humus from *glucose* on the water-bath.

The substances giving rise to the formation of humus are the non-oxiding bases and acids. The reactions produced are as follows:

1. Decomposition of the molecule of the substance; proof of this is the formation of levulic acid and particles of free carbon (which stain the humus formed, since they pass through a filter).
2. Dehydratation by the action of acids.
3. Intra-molecular oxidation.

Thus, the monosaccharides and disaccharides are transformed into polysaccharides, which in their turn undergo subsequent dehydration, resulting in the decomposition of the molecule and oxidation with formation of humus. In cases where oxidation does not take place, *e. g.* during the formation of ulmin and ulmic acid, the action is simply dehydration.

In addition to the action of chemical substances, the writer investigated the influence of temperature ; as a result of these studies he considers that the formation of humus is an intermediate stage in the carbonisation of the material.

Experiments have also been carried out with aldehydes, ketones and the series of polyatomic alcohols. Aldehydes can only promote the formation of humus when associated with other compounds, such as the polyatomic alcohols. Similarly ketones alone do not lead to the production of humus unless associated with compounds of other series.

The writer concludes that the formation of humus should not be considered as due to the disordered decomposition of molecules, but, on the contrary, to a series of definite reactions, especially with associated compounds, such as the aldehyde-alcohols, ketone-alcohols, etc. From these laboratory results he proposes the theory that the formation of humus in nature takes place by an identical process, with the difference that the micro-organisms of the soil play the rôle of the acids and bases.

348 – **A Simple Method for Determining the Critical Moisture Content of Soils.** — Davis, R. O. E., in *The Journal of Industrial and Engineering Chemistry*, Vol. 6, No. 12, pp. 1008-1010. Easton, Pa., December 1914.

The critical moisture content is the content at which the physical properties of the soil attain their optimum value for growth. Previous methods for determining it depend upon the volume-moisture relation or the penetration-moisture relation, and are exceedingly laborious, requiring special apparatus and much time. This new method is based on the capillary movement of the water in the soil. The determination of the moisture content of the first inch of the moist soil column has given values corresponding to the critical moisture content as determined in the ordinary way. The apparatus consists of a brass tube 12 inches long and 1½ inch in diameter, split lengthwise and containing a slit in one of the halves ½ inch wide and extending to within one inch of each end. The slit is covered with a strip of celluloid held in place by drops of solder on the inside of the tube, thus forming a window for observation purposes. Short pieces of copper wire are soldered to the edges of one half of the tube at each end, and are used to hold the two halves of the tube in position. The end that is placed in water is closed by a piece of cotton cloth secured by a rubber band. The great advantage of this tube is that it may be opened up and the soil column removed in its entirely. This can then be divided up and the moisture content of any section determined.

In making the determination, the tube is removed from the water after it has ascended several inches and placed in a horizontal position until capillary movement practically stops. The tube is then opened and a moisture determination made of the moist column of soil in the inch at the extreme end to which the water has advanced.

Some results obtained with this apparatus are shown in the accompanying table.

Comparison of the results obtained by the capillarity method and the apparent specific gravity method.

Type of soil	Percent of moisture by capillarity	by apparent specific gravity
Sandy loam	8.7	8–9
Silt loam I	17.3, 17.0, 16.5	17–18
Garden soil	16.6	16–17
Silt loam II	16.7, 17.0	16–17
Silt loam III	17.4, 17.0	17–18
» » IV	14.5, 14.9	14–15
» » V	8.5, 8.7	8–9

This shows the close agreement between the two methods.

349 – **The Conditions of Fertility of a Soil at Different Depths.** — NOSTITZ, A. VON, in *Landwirtschaftliche Jahrbücher*, Vol. XLVIII, Part 1, pp. 113-152 + 2 plates. Berlin, 1914.

After a review of the most important literature on this subject, the writer describes his pot experiments with rye and with three different kinds of soil (1. loamy sand with a small amount of humus, 2. sandy loam with much fine sand, 3. clay loam containing humus), the second and third of which are divided into three layers: the surface soil to a depth of 10 inches, the soil from 10 to 20 inches, and that from 20 to 30 in. The first is divided into only two layers: surface soil down to 10 inches and lower soil from 10 to 20 in.

One series of experiments was made with these eight samples without manure and another series in which each pot containing 10 kg. (22 lbs.) of earth was treated with:

4 gms.	monocalcium phosphate containing	2.254 gms.	P_2O_5
10 »	calcium carbonate »	5.600 »	CaO
1.44 gm.	potassium sulphate »	0.778 »	K_2O
1.19 »	potassium chloride »	0.751 »	K_2O
0.50 »	magnesium sulphate »	0.167 »	MgO,

besides which, each pot received, in three applications, 300 cc. of 1 per cent solution of nitrate of soda, containing altogether 0.494 gm. N.

The most important results are shown in the following table:

Yield per pot, in grams.

		Without fertilizers			With complete fertilizer		
		Straw	Grain	Air-dried roots	Straw	Grain	Air-dried roots
Soil No. 1	1st 10 inches	19.88	8.71	1.15	47.46	23.11	5.30
	2nd 10 inches	7.65	3.41	0.88	27.55	14.05	3.82
Soil No. 2	1st 10 inches	13.75	8.65	3.31	48.62	21.34	6.54
	2nd 10 inches	7.35	2.50	1.52	38.31	15.58	5.43
	3rd 10 inches	3.60	0.76	0.57	29.61	14.03	4.05
Soil No. 3	1st 10 inches	16.92	7.75	1.81	52.39	23.51	3.89
	2nd 10 inches	7.32	4.01	0.68	35.06	15.95	4.85
	3rd 10 inches	5.32	1.72	1.03	30.64	13.54	5.05

It follows thus that the deeper the layer of soil below the surface, the lower is its productivity, and that the difference between the various layers is diminished but not completely abolished by the use of fertilizers.

The decrease in the yield of the lower layers was not always accompanied by a decrease in the quantity of mineral matter contained in the crop, for sometimes the yield of some of the lower layers contained a higher percentage of salts than that of the higher ones.

The analysis of the plants from the manured series showed that the percentage of nitrogen and of ash in them differed but little with the depth of the layer of soil in which they had grown. The sum of the percentages of phosphoric acid, lime, magnesia and potash was practically the same for the two layers of soil No. 1; while in soils 2 and 3 it increased in the middle layer and still more in the lowest, chiefly owing to the increase of the lime and magnesia content; the phosphorus content of the plants grown in the lowest layer was in all three soils inferior to that of the plants grown in the surface soil. There is no regularity in the potash content of the crops from the three soils: in No. 1 it is the same in the 1st and 2nd ten inches; in No. 2 it increases in the middle layer and diminishes in the lowest; in No. 3 it diminishes slightly in the middle layer and increases in the lowest. The absolute quantities (that is expressed in grams) of nitrogen, phosphoric acid, lime, magnesia, and potash were almost always highest (in connection with the highest yields) in the surface soil and diminished in the lower layers. Exceptions to the above are offered by the yield of the lowest layer of No. 2, which exceeded those of the two higher layers in its lime content, and the yield of the lowest layer of No. 3, which was above the middle layer

in the weight of ash and of the several mineral constituents, with the exception of phosphoric acid.

In the present instance the causes of the lower fertility of the lower layers are to be attributed :

1. To the smaller number of bacteria. It took more than a year to level up this number in the soils taken at different depths.

2. To the lower content of the lower layers in humus, nitrogen and phosphoric acid. In two cases the abnormal colour of the first leaf showed very evidently the want of available potash in the lower layers.

350 – **Partial Sterilisation of Soil by Volatile and Non-volatile Antiseptics.** — BUDDIN, W. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 4, pp. 417-451. Cambridge, December 1914.

In previous experiments on the effect of partial sterilisation of soil by means of antiseptics, only a limited number of chemicals have been used ; in the present investigation the following subtances were studied in this connection :

Benzene	Chloroform
Toluene	Ether
Cyclohexane	Phenol
Hexane	Cresol
Heptane	Quinone
Pentane	Hydroquinone
Formaldehyde	Pyridine
Methyl alcohol	Calcium sulphide
Ethyl alcohol	Flowers of sulphur
Iso-propyl alcohol	Sulphur dioxide
Normal propyl alcohol	Sodium fluoride

Sodium chloride.

The general method adopted was that used by Russell and Hutchinson, and the antiseptics were each tested in proportions varying from M (*i. e.* molecular weight in grams) to M/200 per kilo of soil.

The characteristics of true partial sterilisation were found to be common to a large number of the antiseptics ; these characteristics are as follows :

a) An initial decrease in the numbers of bacteria followed by a large sustained rise.

b) The killing of protozoa and nitrifying organisms. (In no case were all the usual partial sterilisation phenomena observed without the death of the larger protozoa, which occurred abundantly in cultures made from the soils employed).

c) An initial increase in ammonia content followed by a considerable increase in the rate of production of ammonia and consequently in the productiveness of the soil.

d) With any particular chemical, no increase in the dose caused any change in the results obtained once true partial sterilisation had set in.

True partial sterilisation was obtained only with the easily volatile or removable antiseptics. For its detection it was necessary to use all the tests combined ; neither bacterial nor chemical examination of the soils alone was sufficient and even the combined results from a new substance should be compared with the results from a well-known antiseptic such as toluene. Substances not completely removable from the soil had a lasting influence on the flora. With the weaker doses two or three special species of bacteria characteristic of the chemical used multiplied temporarily to an enormous extent ; but the organisms did not produce ammonia, so that there was no gain in ammonia and nitrate to the soil as a result of their action. The higher doses permanently suppressed all microbiological action in the soil. It appeared to be a general rule that a simple flora can attain extraordinarily high numbers, while a complex flora, such as prevails after normal partial sterilisation, does not attain to higher numbers than the comparatively low level of about five times those in the untreated soil.

It was possible to trace a certain relationship between the action of all the substances used. The intensity of the effects shaded off gradually from that of the powerful non-volatile antiseptics through cresol (M/50 dose) and formaldehyde to the more and the less potent volatile antiseptics respectively, till finally the action of merely spreading out the soil in a thin layer was reached (1).

Volatile antiseptics are undoubtedly effective in increasing the productive capacity of a soil under laboratory and pot culture house conditions, but are unsuitable for application on a larger scale. An efficient solid substance would be very convenient in use and probably much cheaper than methods of partial sterilisation by heat. The present experiments have not revealed any suitable new non-volatile substance, but they have emphasised the value and explained the action of phenol and cresol and have emphasised, though not explained, the action of formaldehyde.

Investigations are being continued on the special species of bacteria which are able to withstand unusual doses of the potent poisons and subsequently to multiply rapidly and produce practically pure cultures in the soils.

351 – **Note on the Increased Nitrate Content of a Soil Subjected to Temporary Drying in the Laboratory.** — Buddin, W. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 4, pp. 452-455. Cambridge, December 1914.

In the course of some experiments on the partial sterilisation of soils by antiseptics, the untreated soil was divided into two portions, one of which was spread out in the laboratory for 20 to 24 hours during which time its water content was reduced from about 15 to 5 per cent, then remoistened and bottled; the other portion was bottled directly. After a subsequent incubation period it was found that the dried and remoistened

(1) See below, No. 351 (*Ed.*).

samples contained about twice as much ammonia and nitrates as the samples which had remained moist throughout, although the number of bacteria present in the soil was approximately equal in the two cases. The matter was then further investigated, and the possibility of absorption of ammonia by the soil while spread out was controlled by testing the soil immediately after it had been spread out and then again after a period of incubation. The results were as follows :

Nitrogen as ammonia and nitrate, parts per million of dry soil.

	Immediately after spreading out	After 40 days	Increase
Untreated moist soil	24	36	12
Spread out in laboratory and remoistened .	26	46	20
Spread out in glasshouse and remoistened .	30	53.5	23.5

In the spread out soils a little more nitrate and ammonia was found initially than in the untreated permanently moist soil, but again nearly twice as much nitrate was formed during the incubation period in the spread soils as in the samples which had not been spread out.

Other samples were spread out on copper gauze over concentrated sulphuric acid in a closed atmosphere under a large bell jar, and these again failed to show any real initial difference from the untreated. Thus the increased amount of nitrate found after an incubation period in soils which have been spread out for 24 hours and then remoistened, over that in similar samples which have been kept moist, appears to be due not to absorption from the atmosphere but to the formation of more nitrate from the residues in the soil in spite of the fact that the numbers of bacteria are not increased.

Up to the present no satisfactory explanation of the raising of the limit of nitrate accumulation by spreading out the soil has been found.

352 – **On the Presence of *Azotobacter* in Danish Woods and on the Value of *Azotobacter* Cultures for the Determination of the Lime Requirements in Woodland.** — Weis, Fr., and Bornebusch, C. H., in *Det forstlige Forsøgsvaese i Danmark*, Vol. IV, Part 4, pp. 319-337 (summary in German, pp. 337-340). Copenhagen, 1914.

The present investigations, which dealt with a series of soils taken from Danish forests, form part of the experimentation, which is to be continued in future years, intended to throw light on the natural store of nitrogen in the soil. While so far it has not been demonstrated that green plants (that is those containing chlorophyll) can fix and absorb nitrogen without the agency of micro-organisms (fungi or bacteria), several fungi and bacteria are known to possess such power, either alone or in symbiosis. Among these the one which has attracted most attention of late is

Azotobacter, because it is generally widespread in fertile field and garden soils, to whose nitrogen supply it contributes to an appreciable degree. It was thus obvious to investigate the presence of *Azotobacter* also in forest soils, all the more so as they are capable of maintaining their equilibrium in nitrogen for long periods without artificial manuring; moreover several writers have observed a considerable increase in comparison with the absolute quantity of nitrogen contained in the leaves that fall to the ground. Recently it has been shown that the presence of *Azotobacter* in arable soil depends upon its reaction and on its content of certain compounds of lime and humus; consequently, it is not so generally distributed as was formerly believed: it seems to be rare in peaty soils, and has been shown to be absent from a series of Swiss forest soils, though present in the leaf mould layer.

For the experiments here described, samples of soil were taken from 64 different localities in Danish forests (in Seeland, Lolland and Fünen) and examined in the Laboratory of Agricultural Bacteriology of the Royal Agricultural and Veterinary College in Copenhagen. They were sown in the nutritive solution recommended by BEIJERINCK for *Azotobacter*. Every sample of soil was tested with litmus paper and for calcium carbonate (effervescence with cold, dilute hydrochloric acid); lastly, for 54 samples, *Azotobacter* was inoculated into 50 cc. of a solution similar to Beijerinck's, but with the calcium carbonate substituted by 5 grams of the soil to be examined; thus the bacterium has no available source of lime but that contained in the added soil, and from its development after a few days at 25° C. the lime requirements of the soil may be inferred. (HARALD R. CHRISTENSEN'S method).

The principal results were the following: Of the 64 localities investigated, only in two (the soil of which showed marked effervescence and alkalinity) was *Azotobacter* found, in both cases in the soil of beech woods. It did not, however, belong to the *A. chroococcum* form generally present in arable soil, which after a few days' culture becomes blackish-brown, but to one which forms films which remain whitish; hence it probably belongs to *A. beijerinckii* or *A. vitreum*. The same whitish form was also found on a black moor soil flushed by spring-water and overgrown with ash and alder, at Folehaven (Seeland), and by a roadside at Ordrup-Krat (Seeland), both soils giving marked effervescence with hydrochloric acid.

The forest soils examined rarely contained sufficient calcium carbonate to cause effervescence with hydrochloric acid, even in the numerous cases in which their reaction was neutral or slightly alkaline. Nevertheless they were not without lime in other forms, and could not be defined as requiring liming. The culture experiments with *Azotobacter* gave positive results in 32 cases and negative ones in 22; even in the former, the good development of the trees and the good physical condition of the wooded soil showed that there was no need of liming. In several cases the dry leaves fallen to the ground were examined for *Azotobacter*, but always with negative results. In the cases in which it was looked for in arable soils in the immediate vicinity of woods whose soil did not

contain any species of *Azotobacter*, its presence was easily demonstrated, but the species was always *A. chroococcum*.

The following general conclusions thus seem justified :

1. *Azotobacter* is only exceptionally present in Danish forest soils ; in some localities in which the soil contains much calcium carbonate, *A. beijerinckii* and *A. vitreum* are present. Consequently, for the supply of nitrogen to the forest soils of Denmark some other micro-organisms, probably lower fungi, must be of importance. The causes of the absence of *Azotobacter* from forest soils are perhaps the insufficient quantity of calcium carbonate, the too low temperature and an excess of humic matter.

2. *Azotobacter*, perhaps on account of the low temperature, seems not to be generally present on the fallen leaves in Danish woods.

3. The culture of *Azotobacter* in Beijerinck's nutritive solution in which the lime is replaced by 5 gms. of the soil to be studied, namely HARALD R. CHRISTENSEN'S method, is a rapid and easy way of showing it a woodland to be regenerated requires lime or not, since the calcium compounds that favour the development of *Azotobacter* in such cultures seem to be the same which facilitate the development of those organisms which lead to the production and conservation of a good mould and favour the development of forest trees, especially of beeches.

BIBLIOGRAPHICAL NOTE.

OPENING UP LAND FOR CULTIVATION

353 – VON SEELHORST, CONRAD (Director of the Agricultural Institute of the University of Göttingen). *Handbuch der Moorkultur*. Zweite, gänzlich neubearbeitete Auflage von « Acker- und Wiesenbau auf Moorboden » (Handbook of Moor Cultivation, second, entirely revised edition, of « Arable and Grass Farming on Moor Soils »). — Berlin, Paul Parey, 1914 (1 vol. in 16mo , pp. VIII + 336, 4 plates).

The book begins with the statistics of the moorlands in the German Empire and gives an account of their average yields and the returns from the crops. It then deals with : formation and constitution of peat soils ; cultivation of fens (their drainage, manuring and correction, laying-down of pastures and meadows, "Moordammkultur", *i. e.* the cultivation of the land drained by ditches or tiles and covered with about 4 inches of mineral soil) ; cultivation of true moors ; building of cottages and road-making on low-lying moorland ; best methods of treating the thin layer of surface mould. The book concludes with a bibliography of 59 works and is provided with an alphabetically arranged index.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

354 – **Irrigation in the United States.** — *From Thirteenth Census of the United States, taken in the year* 1910, Vol. VI, Agriculture, pp. 1-326. Washington.

For many years a 20-inch annual precipitation was supposed to mark approximately the dividing line between the sections in which irrigation was necessary to the maturing of crops and those in which it was not necessary. Owing to the great progress of dry-farming, the recognised limit of precipitation required for the maturing of crops has been considerably lowered during the last few years. Nevertheless, unless great precision is desired, the line of 20-inch rainfall may be taken as limiting the sections of the United States where irrigation is commonly practised.

The number of farms on which irrigation was practised, for purposes other than rice growing, in 1909, in the States of the arid region, was 158 713, or 11 per cent of the total number of farms in the same States. While the total number of farms in this region increased 31.5 per cent between 1900 and 1910, the number of farms in which irrigation was practised increased 47.7 per cent.

The acreage reported as irrigated in 1909 was 13 738 485, which constituted 1.2 per cent of the total land area of the same States, 3.5 per cent of the total land in farms, and 7.9 per cent of the improved land in farms. There was an increase of 82.7 per cent in such acreage between 1899 and 1909.

The acreage to which enterprises were ready to supply water in 1910 was 19 334 697, or 5 596 212 acres in excess of the acreage irrigated in 1909, while the acreage included in 1910 in all projects, whether completed or in process of development, was 31 111 142, or 17 372 657 acres greater than the acreage reported as irrigated in 1909.

The total length of the ditches used for irrigation in 1910 was 125 591 miles. There were 6 812 reservoirs, having a combined capacity of 12 581 129 acre-feet, or nearly 1 acre-foot of reservoir capacity for each acre irrigated from any source in 1909.

The number of pumping plants reported was 13 906, and the acreage supplied by them 477 625.

The total cost of irrigation enterprises to July 1, 1910, was $307 866 000, or $15.92 per acre of the land which these enterprises were capable of supplying with water in 1910. The total cost of irrigation enterprises increased between 1900 and 1910 by 359.8 per cent.

The average cost of operation and maintenance per acre of land irrigated, for the year 1909, shows also a large increase — 181.6 per cent — over the cost shown in 1899.

For the arid region as a whole, the average cost of irrigation and maintenance per acre irrigated in 1909 was $1.07. The highest average, with the exception of North Dakota, where a single large project supplied water in 1909 to only a small part of the acreage which it was designed to serve, was shown by Texas, with $3.25, and the lowest by Oklahoma, with $0.51.

One of the most significant facts brought out by the special census of irrigation, is that the acreage included in all enterprises either completed or under construction in 1910 was more than 17 000 000 acres in excess of the acreage irrigated in 1909. This would indicate that a yearly increase equal to the average annual increase for the decade 1899-1909 could be made in the amount of irrigated acreage for almost 30 years without the undertaking of new enterprises. Nevertheless there is probably sufficient ground for stating that the yearly increase in the irrigated acreage shown for the period 1899-1909 could continue only for another decade without new undertakings.

The increased cost of water supply necessitates a higher type of agriculture, if farming is to be profitable.

The rate of increase in the average value per acre of crops grown un-

der irrigation was, however, less than the rate of increase in the average cost of the water supply per acre. A further improvement in crop returns is therefore needed to meet the increased cost of obtaining the water.

Under the increased cost of water supply, the opportunity of settling such lands is practically limited to a small class of persons with capital, unless some plan is devised to extend the time of payment over a long series of years, and perhaps extend some help to settlers during their first few years on the land.

A significant feature of the returns of the census of 1910 is the large increase in the acreage supplied with water from wells: 178 200 acres in 1899 and 451 896 in 1909. It is to be expected that this source will be still more largely used in the future.

With the exhaustion of the summer flow of streams, the extension of the irrigated area is becoming largely dependent upon the storage in reservoirs of the flood and winter flow of streams. Sufficient storage capacity for the unused flood waters has been provided on only a few of the streams of the arid region, and this is the more promising field for future expansion.

The average quantity of water provided for the irrigation of land during the irrigating season of 1909, as shown by the returns, was 4.8 acre-feet. Measurements reported by the office of Experiment Stations indicate that not more than 50 per cent of the water entering the canals is actually delivered to the fields for use. The prevention of these wastes, and the practice of economy in the use of the water, offer a large field for increasing the available water supply and extending the irrigated acreage.

Practically four-fifths of the land irrigated in 1909 (79.3 per cent) was supplied by cooperative and individual and partnership enterprises, which operate under the general laws of the Western States.

Commercial enterprises, which furnish water for irrigation for a compensation, supplied 10.6 per cent of the land irrigated in 1909. As a rule enterprises of this type are not large and are constantly being reorganised into cooperative enterprises and irrigation districts, but new ones are as constantly formed, since this type of enterprise is peculiarly adapted to reclaiming new lands on a comparatively small scale, being free from all the restrictions which apply to the various types of public enterprises.

355 – **Subsoil Drainage in Paddy Lands**. — Wood, R. Cecil (Principal, Agricultural College, Coimbatore) in *The Agricultural Journal of India*, Vol. IX, Part III. Calcutta and London, July 1914.

This paper is a short account of the experience gained in laying down subsoil drains in paddy land.

The ground chosen for the experiment was about 1 $\frac{1}{2}$ acres in extent and is not affected by excess of water. It was more in the hope of reducing the alkalinity from which the land suffers, that the experiment was carried out.

Eight drains were laid 21 feet apart : each drain was 400 feet in length and had a fall of from 1.35 to 0.7 feet.

Two kinds of drains, were used : one, a plain loose stone one, the other made of bamboo tubes. The drains were 2 ft. 6 in. deep, the stones being filled in to a breadth of 1 ft. and a depth of 6 in. The bamboos were also packed in stone to a depth of 6 in. The tubes were simply bamboos of about 3 in. bore cut at the internodes into lengths of about 1 ft. 3 in. The diaphragms were removed and the whole piece dipped in tar. They were laid end to end, being threaded up on long thin bamboos. The cost of the stone drains was 8.82 pies per running foot or Rs. 95.7.3 per acre, that of the bamboo drains, 10.14 pies and Rs. 109.11.10 respectively.

The drains were laid in 1910 and after three years cropping have recently been examined. The bamboos were found in a very good state of preservation, but were blocked in several places by silt, owing to displacement of the pipes and to the inadequate fall. This latter is the main difficulty, since on this class of land a considerable fall is seldom available.

That these drains have resulted in an improvement in the land, there is little doubt. A more alkaline piece of land has now been chosen for further trial, since if such land could be reclaimed at Rs. 100 an acre it would show a very large profit.

Other experiments of underdrainage were carried out at Saidapet in Madras.

More recently experiments have been made at Sivagiri. Stone drains were laid down in clayey alkaline paddy land and have been running well for five years, to the marked improvement of the land.

BIBLIOGRAPHICAL NOTE.

356 – *Land Improvements in Switzerland. (Les Améliorations foncières de la Suisse).* — Report elaborated by the Federal Department of Agriculture from the Cantonal Reports. Berne, Imprimerie K. J. Wyss, 1914 (1 vol. in 8vo, 231 pp.).

This publication deals first with the measures of the Confederation for the promotion of a movement in favour of land improvements in the Cantons and gives the reports of the various Cantons. The reports are supplemented, according to an established programme, by plans, maps, statistical tables, etc., of the work carried out, and by a table showing the amounts granted by the Confederation and the Cantons in favour of soil improvements.

357 – **The Prevention of Loss from Manure Heaps in Winter and Early Spring.** — Russell, E. J., and Richards, E. H., in *The Journal of the Board Agriculture*, Vol. XXI, No. 9, pp. 800-807. London, December 1914.

MANURES AND MANURING.

A considerable degree of improvement is still possible in the management of the manure heap, as it is estimated that on an average nearly half the value of the yard manure made on an ordinary farm is lost. The study of the causes of this loss has, besides a great practical value, a still greater scientific importance, as it has long been known that the return obtained by a given application of nitrogen, in whatever form, is not as high as might be expected, there being a considerable margin of unaccounted loss. This has for some time been under investigation at Rothamsted and has proved a

very difficult problem, but it has gradually become evident that the solution is to be sought in a study of the losses from the manure heap.

In the first place, a careful distinction must be drawn between the *losses in making* and the *losses in storing* farmyard manure. It has been proved (J. A. VOELCKER, T. B. WOOD and E. J. RUSSELL) that the former amount to about 15 per cent in the most favourable conditions when the manure is made from fatting beasts in a stall and is left undisturbed and unaffected by drainage until it is carted out, and no means is known of preventing this loss. On the other hand the writers show that it is possible to reduce the losses during storage to practically nothing.

The losses during storage are due to three causes: rainfall, moving the heap and dissipation of valuable nitrogenous compounds in the form of gas. Heaps stored at Rothamsted and at a private farm at Woking were used by the writers for their investigations.

Losses in heaps left in the open. — One heap was kept in the open at Rothamsted from January to April 1914, and one at Woking from November 1913 till May 1914. The losses were found to be considerable: the dry matter of the heap suffered losses of 20 and 30 per cent respectively; the nitrogen diminished by 24 and 33 per cent respectively; and the phosphoric acid also fell off by 8.3 per cent (at Woking). The nitrogen that is lost is mostly from ammonia and the amides, that is the easily available portion. The value of the loss in nitrogen is not less than 1*s* 6*d* per ton of manure in three months' exposure at Rothamsted, and 3*s* per ton in the six months at Woking.

Losses in heaps under cover. — Two similar heaps were put up for the same periods under cover, so that no rain could fall on them. At Rothamsted the loss of dry matter was 7.5 per cent and of nitrogen 6.9 per cent; at Woking the figures were respectively 26.5 and 7.9 per cent. The losses of phosphoric acid were practically *nil* at Woking. The comparison of these figures with those of the preceding experiment show that *rain is the most potent source of loss in a manure heap.*

Finally a heap was put up to ascertain what loss took place when rain was kept off and gas dispersion prevented, as far as possible, by compacting the heap. In this case the loss of dry matter was limited (4.4 per cent) and the loss of nitrogen *nil*. This shows that the *loss on storage can be prevented by compacting the heap and keeping it under cover.*

Action of rain. — This part of the experiment is not yet complete. It has, however, already become evident that the action of rain is something more than a mere washing away of soluble material. This was proved by putting up a heap under cover and watering it daily, but never to the extent of causing any perceptible increase of drainage from the heap as compared with an adjacent unwatered heap. The losses in three months of the watered heap were: dry matter 5.1 per cent; nitrogen 13.6, of which one half in easily available form. The total loss of nitrogen in the watered heap was double that incurred in the unwatered heap, in spite of the fact that there was no appreciable increase in drainage. The question arises: how was this nitrogen lost?

For a long time it was thought that a large part of the losses of a manure heap is due to volatilisation of ammonia; hence the use of " fixers " (superphosphate, kainit, etc.) has been recommended, as well as pumping back the drainage on to the heap. Numerous experiments, however, have shown the futility of fixers, and the experiments of the writers have shown that as a means of reducing the loss, this method also is not a success, though it is useful from another point of view.

Some volatilisation of ammonia undoubtedly takes place, but it is neither the sole nor the main cause of loss. The experiments of the writers prove that nitrates may be produced on the outside of a heap but not in the inside, and, moreover, that any nitrate washed inside by the rain rapidly decomposes with loss of nitrogen. *It suffices that the nitrate be washed a short way down and the decomposition soon becomes complete.*

Thus the old view that loss is due to volatilisation as ammonia can no longer be regarded as accurate, and consequently the methods based upon this view have failed in practice. It now appears that rain is the great enemy and that in order to save the heap as much as possible it must be protected from rain.

Effect of moving the heaps. — The heaps at Rothamsted were all thoroughly turned over at the end of three months and then set up again and left for another three months till July. The losses during the second three months were as follows :

	Heap fully exposed to rain	Heap partly exposed, watered artificially	Heap completely sheltered	
			Not compact	Compact
Loss of dry matter, per cent	13.23	11.6	24.3	8.6
Loss of nitrogen :				
a) easily available	6.6	11.5	20.3	13.2
b) less available	3.4	1.0	7.4	0.7
Total, per cent	10.0	12.5	27.7	13.9

It thus seems clear that the shifting of the heaps is a very potent cause of loss.

358 – **Valuation of the Manurial Residues Obtained from the Consumption of Foods by Growing Pigs.** — CROWTHER, CHARLES, and RUSTON, ARTHUR G. (Department of Agriculture, University of Leeds), in *The Journal of the Board of Agriculture*, Vol. XXI, No, 9, pp. 789-800. London, December 1914.

It is rapidly becoming a general practice to base the valuation of unexhausted manurial residues arising from the consumption of foods by stock upon the composition of the foods which gave rise to the manure. LAWES

and GILBERT, and recently HALL and VOELCKER (1), evolved a method of applying the above principle, and the two latter have drawn up "compensation tables" based upon a careful survey of the available evidence as to the extent to which the manurial ingredients present in foods consumed by fattening bullocks are recoverable in the manure produced under the conditions of good farm practice. Hence, strictly speaking, HALL and VOELCKER'S tables can only be held to apply to the particular class of feeding and stock mentioned, and special cases demand separate treatment.

Of these special cases, the writers consider that of feeding young pigs, which differs radically in many respects from that of other farm animals. It is well known that in proportion to its weight the pig eats more dry substance in the form of food and voids less dung than any other farm animal.

The writers determined experimentally the consumption and outgo of the manurial ingredients in the growing pig. Two groups of five pigs of Large White Yorkshire breed, 63 days old, were fed from separate troughs for each animal. During five days in each fortnight the pigs received no food of any description other than that supplied in the troughs, but on other days they were turned out on grass for a few hours each day.

This system was adopted as it was feared that continuous confinement might be injurious to the satisfactory development of the animals. Preliminary experiments having demonstrated that the undigested residues from the food consumed one day would be completely voided within 48 hours, this period was therefore allowed to elapse before any collection of dung and urine was made.

The experiment was commenced on June 30 and continued until December 8, 1913 — a period of 23 weeks. At the outset, the average weight of the pigs in group *A* was 25 lbs. 8 oz. and in group *B* 26 lbs. 2 oz. The average weekly gain per pig over the period of 23 weeks was 6 lbs. 4 oz.

The foodstuffs used were wheat-bran, sharps, pea meal and barley meal. During the last eight weeks of the experiment a weighed small quantity of finely ground chalk was added. The weekly consumption of dry food rose steadily from 4.6 lbs. to 37 lbs. per pig and of water from 35 lbs. to 105 lbs.; the latter contained 18.5 parts of lime and 3.2 parts of potash per 100 000, with a trace of nitrogenous matter.

The percentage composition of the foodstuffs with respect to the chief manurial ingredients is indicated in Table I.

TABLE I. — *Fertilising ingredients in the foods supplied.*

Food	Nitrogen	Phosphoric acid	Potash	Lime
Bran	2.06–2 59	2.46–2.69	1.19–1.46	0.19–0.28
Sharps	2.07–2.29	1.66–2.00	0.99–1.23	0.09–0.15
Pea meal	2.86–3.20	0.93–1.25	1.01–1.28	0.09–0.14
Barley meal	1.46–1.71	0.87	0.33–0.48	0.04–0.06

(1) See *B.* Jan. 1915, No. 18. (*Ed.*)

The weights of dung and urine per pen collected during the three day experimental period ranged as follows :

Dung	in group	*A*	from	12 lbs.	10 oz.	to	65 lbs.	6 oz.
	»	*B*	»	11 lbs.	6 oz.	»	61 lbs.	14 oz.
Urine	»	*A*	»	37 lbs.		»	138 lbs.	
	»	*B*	»	32 lbs.		»	135 lbs.	

The percentage of dry matter in the dung rose steadily as the food supply was increased, the range being from 16.7 per cent to 22.6 per cent in the case of group *A*, and from 17.8 per cent to 24 per cent in group *B*.

Taking the average of the whole period (mean of the two groups) of the fertilising matters present in the food, there were recovered in the fresh excreta :

Nitrogen	56 per cent
Phosphoric acid	58 »
Potash	87 »
Lime	65 »

A survey of the available data led HALL and VOELCKER to conclude that even under the very best conditions of storage of manure the loss of nitrogen will commonly amount to between 30 and 40 per cent of the nitrogen fed. This would imply in the case under discussion, where 44 per cent of the nitrogen of the food was already missing from the fresh excreta, that by the time the manurial residues were applied in the field, they would contain probably only from 16 to 26 per cent of the nitrogen originally present in the foods consumed. The writers believe that with precautions against loss by drainage the loss of phosphoric acid and potash during storage of the manure should not amount to more than 5 to 10 per cent.

On the basis of the foregoing experimental data and considerations, it is concluded that in the compensation to be allowed for the unexhausted manurial residues from foods consumed by growing pigs, these residues ought not to be credited with more than 25 per cent of the nitrogen, 50 per cent of the phosphoric acid, and 80 per cent of the potash present in the foods. (The coefficients of HALL and VOELCKER dealing more specifically with the case of fattening cattle are 50 per cent of the nitrogen, and 75 per cent each of the phosphoric acid and potash).

In the case of adult pigs the utilisation of food is different and would appear to be adequately served by HALL and VOELCKER's figures. This is shown by experiments made by the writers, which are summarised in Table II, in which the results are grouped in three periods, in order to bring out more clearly the improvement in the recovery of manurial ingredients — phosphate excepted — with advancing age of the pigs :

TABLE II. — *Percentage of fertilising ingredients of food recovered.*

Age of animals	Nitrogen	Phosphoric acid	Potash
Months	Per cent	Per cent	Per cent
2–4	40	64	77
4–6	51	64	86
6–8	63	51	91

It is clear that beyond 8 months, the degree of recovery would have been practically up to the standards of HALL and VOELCKER'S table.

The data contained in Table III show that the urine contains a high proportion of the manurial ingredients, practically 63 per cent of the total manure value, which the writers assess at 3*s* 4*d* per pig during the whole time of the experiment, taking the following unit values per ton : nitrogen 12*s*, phosphoric acid 3*s*, and potash 4*s*.

TABLE III. — *Recovery of fertilising matter in dung and urine.*

	Recovered from 100 parts consumed in food		The same expressed as percentage of total amount recovered	
	In dung	In urine	In dung	In urine
			Per cent	Per cent
Nitrogen	19.6	36.7	35	65
Phosphoric acid	44.5	13.0	77	23
Potash	15.7	71.2	18	82
Lime	59.7	5.4	92	8

359 – **Experiments with Cover Crops in Southern California.** — MERTZ, W. M., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 10, pp. 398-402. Sacramento, Cal., 1914.

In 1909 the University of California inaugurated an experiment at Riverside to determine the value of legumes as winter green manure crops for citrus fruits.

The experiment consists of two divisions. In the first part on nine plots different legumes are grown, and on eight check plots, each of which lies next to a legume plot, cereals are grown. Each plot is one-tenth of an acre in extent. The seeds of the legumes are all sown during the early part of September. At the ordinary time for ploughing in, squares of twenty by twenty feet in each of the plots are measured off and the actual weight of green tops produced is determined. From this the tonnage of green tops per acre of the various legumes is computed.

The tops from these squares are then spread out over the area cut and a fertilizer is uniformily applied over the entire area under experiment. This

fertilizer consists of 540 lbs. of finely ground raw phosphate rock, and 320 lbs. of sulphate of potash to the acre. The whole is then ploughed under to a depth of 9 or 10 inches. The soil is thus prepared for the planting of the summer crops, which forms the second part of the experiment from which the results of the nitrogen added by the various legumes are obtained.

Vegetables such as corn, potatoes, sugar-beets, sorghum, etc., are sown so that each cover crop has growing upon it during the summer the same sized plot of each vegetable used. During the growth of these vegetables nitrate of soda in amounts varying from 270 lbs. to 1080 lbs. per acre is applied in three applications to every second non-legume plot. Uniform cultivation and irrigation are given to all plots.

The following are the average yields in tons per acre of green tops and barley :

Purple vetch (*Vicia atropurpurea*)	18 1/2 tons
Tangier peas (*Lathyrus tingitanus*)	14 »
Melilotus clover	12 3/4 »
Fenugreek	12 1/3 »
Common vetch (*V. sativa*)	12 »
Lentils	12 »
Burr clover	12 »
Barley and rye (average)	12 »
Bitter vetch (*V. ervilia*)	11 1/2 »
Canadian field peas	9 »

The total cost of growing these legumes, including cost of seed, sowing and two extra irrigations, averages $ 8 per acre and is practically covered by the saving due to the cessation of cultivation for the period of five to six months that the land is occupied by the cover crops. Thus the large amount of valuable organic matter does not cause any additional expense.

The table (p. 558) gives the average annual yields of three of the vegetable crops used in the experiment. The figures for the maize are the averages of four years, those of potatoes and sugar-beets are two-year averages.

As for the increases in pounds of material actually produced on plots that received nitrogen from cover crops or nitrate of soda over the yield of barley plots, they stand in the following order : -

Tangier peas *
Melilotus clover
Barley plus 1080 lbs. nitrate of soda
Canadian field peas
Lentils
Burr clover
Barley plus 540 lbs. nitrate
Fenugreek
Barley plus 810 lbs. nitrate *
Vetch (*V. ervilia*)
Vetch, common (*V. sativa*)
Barley plus 270 lbs. nitrate.

* These plants lie next the public road and suffer certain losses for this reason and so in reality cannot be compared with the others

Soil treatment	Shelled corn, bushels per acre	Potatoes, bushels per acre	Beets, tons per acre
Common vetch	35	171	15.3
Barley plus 810 lbs. nitrate of soda	34	191	16.0
Burr clover	35	228	17.3
Barley	29	152	13.4
Barley plus 270 lbs. nitrate	32	166	12.5
Vetch (*V. ervilia*)	38	231	16.7
Barley	27	166	10.7
Canadian field peas	40	243	17.6
Barley plus 1080 lbs. nitrate	41	218	17.7
Tangier peas	42	227	20.5
Barley	28	163	12.3
Melilotus clover	46	252	19.8
Barley plus 540 lbs. nitrate	42	204	15.7
Fenu reek	43	255	16.8
Barley	35	164	12.7
Lentils	42	204	19.5
Average yield on legume plots	40	226	17.9
Average yield on barley plots	30	161	12.3
Average increase due to nitrogen added by legumes	10	65	5.6

Among the new legumes lately introduced by the Bureau of Plant In dustry of the Department of Agriculture, two are very promising: they ar the Tangier pea and the purple vetch. The former, however, has one grea fault: the seed is very difficult to produce. The other legume, the purpl vetch, grows more rapidly in the autumn than any other legume tried: it i aphis resistant and so vigorous that weeds have absolutely no chance to de velop with it.

360 – **Ashes of Hedge Clippings and Trimmings as a Source of Potash.** — Rus SELL, E J., in *The Journal of the Board of Agriculture*, Vol. XXI, No. 8, pp. 604-60 London, 1914.

The writer, Director of the Rothamsted Experimental Statio has conducted a series of experiments to ascertain what amount of potas can be collected from the ashes of hedge clippings and trimmings und ordinary farm conditions.

Just after the harvest and during the winter a certain amount of hedg ing and ditching is carried out on most farms. The material thus remove (grass, dead and green wood) is bulky, and must be burned promptly i order to get rid of it. The ash of this material was analysed and found t

contain from 9.6 to 13 per cent of potash (K_2O), on average 10.9. It is thus nearly as rich as kainit, which contains 12.5 per cent of potash.

At threshing time also a large quantity of material accumulates which cannot be safely trodden into the dung heap because it contains weed seeds, and is either put onto the pastures or burnt. A large heap of this material was burnt and the ash was found to contain 10 to 11 per cent of potash; at normal times it would be worth about 40*s* a ton, so that its collection should become part of the ordinary work of the farm. One very important matter needs attention, namely that the combination of potash present in the ash is the carbonate, the most soluble of all potassium compounds and the one that keeps least well in a damp atmosphere. Two heaps of ash left out one night during which 0.09 inch of rain fell, lost half their potash content; thus ashes, to be of any practical use, must be collected at once and not be exposed to rain. If it is necessary to leave them in the field to cool, a shelter may be readily improvised to protect the heap overnight. In order to save time and labour the trimmings should be burnt on the spot and not carried to one large heap.

The cleaning out of the hedge bottoms yielded about 5 lbs. of ash, while the trimmings gave about 10 to 20 lbs. (average 15) per 100 yards of hedge. A 20-acre field with 1300 yards of hedge would therefore yield ash equivalent to more than 2 ½ cwt. of kainit.

The further question arises: is it worth while turning a man on to cut and trim hedges simply for the sake of the cuttings? To answer this question account was kept of all the labour required to cut the hedge, to burn the rubbish and to collect the ash. The results were that the cost of the ash varied from 3 to 8½ *d* per lb. when the rubbish was mainly grass, and 1½ to 2 ¾ *d* when it was more wood than grass. In another case the ash cost 1*d* per lb.; even this, however, is high and is equivalent to kainit at £9 10*s* per ton.

A further experiment was made to discover what weight of ash was obtained by burning waste cavings, etc., obtained during threshing. The produce of 13 acres gave 678 lbs. of ash, approximately 52 lbs. per acre. It contained 11.2 per cent of potash (K_2O). In ordinary practice the amount of ash per acre might be less, as more of the cavings could be used for feeding purposes, but a certain quantity is always obtainable and should be carefully saved.

361 – **Nitrogen of Processed Fertilizers.** — LATHROP, ELBERT C., in *The American Fertilizer*, Vol. XLII, No. 1, pp. 37-49. Philadelphia, January 9, 1915.

The "base goods" or wet-mixed fertilizer chosen for a chemical study of the processed fertilizers was obtained directly from the factory.

This fertilizer is made by the treatment of various trade wastes and refuse, such as hair, garbage tankage, leather scraps, etc., with rock phosphate and the requisite amount of sulphuric acid. These materials are mixed together in a "den" and the resulting mass is allowed to stand for several days, until it is cool enough to be conveniently handled. In the course of the reaction the mass reaches a temperature approximating 100° C., and the identity of the original substances is almost or entirely lost. Under

these conditions it is certain that more or less hydrolysis of the proteins in the crude materials takes place, with the formation of proteoses, peptones, polypeptides, or the simple amino-acids, the kinds and number of products formed necessarily depending on the proportion of the different proteins in the original materials, on the amount and strength of the acid, the length of time of the reaction and the temperature reached during the treatment.

HARTWELL and PEMBER have recently made a study of base goods in order to determine the availability of the nitrogen contained in it as compared with that of the high-grade nitrogenous fertilizers.

The product which they used was made from hair tankage, garbage tankage and roasted leather, together with rock phosphate and sulphuric acid. From their report the following figures for the analysis of the crude materials used in producing the fertilizer, and of the finished products, are taken.

TABLE I. — *Total Nitrogen in Crude Materials and Finished Product (Hartwell & Pember).*

	per cent
Hair tankage	6.28
Roasted leather	6.49
Garbage tankage	2.87
Base goods including the above	1.68
Water-soluble nitrogen in base goods	1.28
Water-insoluble nitrogen in base goods	0.40

In the present investigation the total nitrogen (1.61 %), and the total ammonia (from 0.374 % to 0.420 % according to the method employed) were determined, and the nitrogen partition was studied, following the Van Slyke method.

The compounds which were isolated from the base goods are tabulated in Table II:

TABLE II. — *Organic Compounds Isolated from Sample of Base Goods.*

Compound	Chemical Group	Source of Compound
Arginine	Diamino acids or hexone bases.	Products of protein hydrolysis by acid treatment of raw material.
Histidine		
Lysine		
Leucine	Monoamino acids.	
Tyrosine		
Guanine	Purine base	Plant constituent, or product of hydrolysis of nucleoprotein.
Hypoxantine	Purine base	Plant constituent, or product of conversion of nucleoprotein base.

The conclusions which are to be drawn from the results obtained by the examination of this fertilizer by means of the analytical and isolation me-

thods are as follows : The process by which the nitrogen of certain trade wastes, such as hair, leather, garbage, etc., is made more available, is recognised as a process of partial hydrolysis of the complex protein contained in such materials, resulting in ammonia, amino acids, etc., all of which are more available than the original protein material. This hydrolysis is almost complete, the nitrogenous compounds formed being principally the primary products of protein hydrolysis, together with a small amount of proteose-like compound which has not been fully decomposed. The water-soluble nitrogen of this fertilizer should have an availability equal to or greater than that of the nitrogen of dried blood or other high-grade fertilizers. These results are in accord with the results obtained by the plant method of determining availability.

362 – **The Acidity of Sphagnum and its Relation to Chalk and Mineral Salts.** — Skene, Macgregor (Lecturer in Vegetable Physiology, Aberdeen University) in *Annals of Botany*, Vol. XXIX, No. CXIII, pp. 65-87. London, January 1915.

While the majority of plants that are considered as calcifuge are not absolutely so, but are so dependently upon the action of various external factors (for instance *Castanea vesca* which cannot grow on chalk unless an abnormally high percentage of potassium be present), some plants are constantly calcifuge. Of these one of the most striking examples is afforded by the genus *Sphagnum*, the members of which are rapidly killed off by water containing calcium carbonate.

Chalk acts in a number of quite distinct ways; sometimes its effect may be indirect, at other times it modifies the physical or chemical properties of the soil or acts chemically on the supply of other salts through the roots. Another extremely important effect of the chalk is that it alters the reaction of the soil, rendering it neutral or alkaline. To this is probably due its fatal action on *Sphaghum*.

The writer reviews critically the earlier observations on *Sphagnum* and its relation to chalk and then describes his own experiments which prove the following facts :

Sphagnum has the property of liberating acids from their salts; this property is possessed by all the parts of the plants, but especially by the stems, and not only by plants in the fresh state but also by plants dried for several hours at temperatures of over 100°C. and by those deprived of their cell contents. The writer has observed that several other mosses and lichens have the same properties as *Sphagnum*. The acidity of the different species of *Sphagnum* (that is the number of grams of hydrogen of the acid radicle which may be freed by 100 gms. of the plant) varies with the species, with the seasons of the year, with the rate of growth and with the salt supply. The writer's experiments confirm the view that species living in stations poor in foodstuffs require the highest acidities in order to obtain the necessary amounts of bases. The different *Sphagnum* exhibit different degrees of sensitiveness to chalk. *S. rubellum* is the most sensitive, *S. contortum* the least. The more acid species are the more sensitive and viceversa, but the parallelism between the two phenomena is not perfect.

Sphagnum thrives in acid solutions; the injurious effect of chalk and of alkalies in general, is due to the substitution of an alkaline for an acid reaction. Mineral solutions are generally physiologically harmless, but may be ecologically harmful, by favouring the growth of other plants, algae for instance, which take the overhand. *Sphagnum* does actually utilise in growth bases held absorbed by the acid compounds of the cell-walls. The literature quoted includes 32 works.

363 - **The Relative Water Requirement of Plants** (1). — BRIGGS, L. J. (Biophysicist) and SHANTZ, H. L. (Plant physiologist, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. III, No. 1, pp. 1-63, + 7 plates. Washington, D. C., October 15, 1914.

This is a continuation of previous experiments carried out during 1911-1913. During the last year the number of species and varieties was increased from 44 to 55.

For purposes of comparison, the plants have been arranged under three main heads: 1. Grain crops (including sorghums and millets); 2) other crops (legumes, cucurbits, crucifers, sugar-beets, cotton, potatoes and introduced grasses); 3) native plants (indigenous and acclimatised species). The grain crops fall naturally into two sections: those of low water requirement — proso (*Panicum miliaceum*), millet (*Chaetochloa italica*), sorghum (*Andropogon sorghum*) and maize — and those of high water requirement — wheat, barley, oats, rye and flax. The plants with a comparatively low water requirement are late maturing crops which make their best growth during the hottest and driest portion of the summer, whilst those of high water requirement mature during midsummer and make their best growth during the earlier cooler period of the year.

The range in water requirement of the first group is from 261 for Kursk millet to 468 for Sudan grass (*Andropogon sorghum*), while the range in the second group is from 473 for Turkey wheat (*T. aestivum*) to 905 for flax. Representing the water requirement of proso by 1, the water requirement of the grain crops is as follows: millet, 1.06; sorghum, 1.10; maize, 1.26; teosinte (*Euchlæna mexicana*), 1.34; wheat, 1.76; barley, 1.83; buckwheat, 1.98; oats, 2.04; rye, 2.34; rice, 2.42; and flax, 3.38. In other words, flax requires more than three times as much water and rice more than twice as much water as proso and millet in producing a pound of dry matter.

In the second group sugar-beet ranks first, having a water requirement almost as low as corn. The potato ranks next, followed by crucifers, cucurbits, legumes and grasses, in order. Each of these families shows a wide range, though somewhat less than those of the grain group.

Representing the water requirement of sugar-beet as 1, the values for the "Other crops" exclusive of legumes are: cabbage, 1.36; Irish Cobbler potato, 1.39; water-melon, 1.51; cantaloupe, 1.57; turnip, 1.60; cotton, 1.63; cucumber, 1.80; wheat grass (*Agropyron smithii*), 1.85; rape, 1.87; squash, 1.89; pumpkin, 2.10; and brome grass, 2.56.

(1) See also *B.* Jan. 1914, No. 20. (*Ed.*).

The cowpea is the most efficient of the legumes. Representing its water requirement by 1, the other legumes are as follows: Peruvian alfalfa, 1.14; chick pea (*Cicer arietinum*), 1.16; soy bean, 1.18.; navy bean (*Phaseolus vulgaris*), 1.20; hairy vetch (*Vicia villosa*), 1.21; sweet clover (*Melilotus alba*), 1.35; Mexican bean (*Phaseolus vulgaris*), 1.35; horse bean (*Vicia faba*), 1.36; red clover, 1.38; Canada field pea (*Pisum sativum*), 1.38; crimson clover, 1.41; wild soy bean, 1.42; select Grimm alfalfa, 1.48; yellow-flowered alfalfa (*Medicago falcata*), 1.51; purple vetch (*Vicia atropurpurea*), 1.64; and unselected Grimm alfalfa, 1.69.

The native plants show a range in water requirement greater even than the cultivated crops. Amaranths, buffalo and gama grasses (*Bulbilis dactyloides* and *Bouteloua gracilis*), purslane (*Portulaca oleracea*), and Russian thistle (*Salsola pestifer*), have a low water requirement and compare favourably with millet and sorghum, while sunflower, fetid marigold, (*Boebera papposa*), western ragweed (*Ambrosia artemisiifolia*) and western wheat grass (*Agropyron smithii*) have a high water requirement equal to that of alfalfa.

Varieties of the same crop often differ widely in water requirement. In the case of barley, the variety having the highest water requirement was 8 per cent above the lowest; oats, 11 per cent; wheat, 18 per cent; proso, 27 per cent; maize, 31 per cent; vetch, 35 per cent; alfalfa, 48 per cent; sorghum, 60 per cent; and millet, 70 per cent. This wide range among the varieties encourages the belief that strains may yet be secured which are still more efficient in the use of water than those now grown in dry-land regions.

364 – **On the Relation between the Concentration of the Nutrient Solution and the Rate of Growth of Plants in Water Culture.** — STILES, WALTER, in *Annals of Botany*, Vol. XXIX, No. CXIII, pp. 89-96. London, January 1915.

As a result of the researches conducted during the last fifty years on the effect of the concentration of the nutrient solution on the growth of plants, it has become clear that plants grow quite healthily in extremely dilute solutions, but the different writers reach different conclusions as to the rate of growth of plants in such solutions being as great as that when higher concentrations are used.

In conducting experiments involving the use of water cultures two main difficulties present themselves. In the first place the development of plants growing in water cultures under exactly the same conditions is very variable. Secondly all ions are not absorbed by the plant at the same rate; the result is that not only the concentrations but the relative proportion of the constituents of the nutrient solution are always changing.

In order to reduce the errors arising from these sources the writer used seeds (rye and barley) of as pure a strain as could be obtained and renewed the nutrient solution every three to five days, except in some instances where inquiry was made into the effect of not changing the nutrient solution. The solutions used were of the relative concentrations: 1, $^1/_5$, $^1/_{10}$, $^1/_{20}$. The composition of the strongest solution was as follows:

KNO_3	1 gm.
$CaSO_4$, $2H_2O$	0.25
$MgSO_4$, $7H_2O$	0.25
KH_2PO4	0.25
NaCl	0.04
$Fe(NO_3)_3$, $6\ H_2O$	0.04
Water	1000 cc.

With frequent changing of the nutrient solution, the dry weight of the barley plants varied from 0.669 to 0.587 in the most concentrated nutrient solutions and from 0.486 to 0.456 in the $^1/_{20}$ solution, while with infrequent changing the dry weight of the plants varied from 0.442 gm. in the most concentrated solution to 0.266 in the $^1/_{20}$ solution.

The above results show that if the nutrient solutions in water cultures are changed frequently, so as to maintain more nearly a constant composition of the solution, the concentration of the solution may vary considerably without producing much effect on the rate of the cultures. Below a certain concentration, however, there seems to be an indication that the rate of growth becomes less. When, on the other hand, the nutrient solutions remain unchanged a marked depression of the rate of growth occurs. It might be caused by the harmful effect of excreta from the plant, or more probably by the absorption of different ions at different rates, which would result after a time in an alteration in the relative proportions of the different substances in the solution. In the case of very weak solutions, a starvation effect owing to exhaustion of some particular salt or ion might result.

The writer confirms the observation that with decreasing concentration of the solution the growth of the shoot is affected much more than that of the root; it is also more affected when the culture-solutions are not changed frequently.

CAMERON calculated that the soil solution contains about 28 parts of potash (K_2O) and about 7 parts of phosphoric acid (P_2O_5) per million. Thus the weakest solution used by the writer was of the same strength in regard to potash and phosphate as that of the soil solution, and although the plants grown in this dilutest solution produced somewhat less dry matter than those in higher strengths, the difference was not great and the plants were perfectly healthy.

It may thus be concluded that the concentration of the soil solution, low as it is, is yet high enough to produce healthy plants.

365 – **Influence of Fluorine on Vegetation.** — GAUTIER, ARMAND, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 6, pp. 194-195. Paris, February 8, 1915.

For some years past the writer, in collaboration with P. CLAUSMANN, has been engaged on the estimation of fluorine and the determination of its function in living organisms. He has already shown that fluorine exists in them in two forms, but always accompanied by phosphorus. In one (that destined to be excreted), fluorine and phosphorus are combined al-

most in the same proportions as in apatite; in this form it accumulates in the epidermis, in hairs, nails, tooth-enamel, etc. The other form is that in which fluorine is found in all the cells having intense life (glands, muscles, nervous tissue, etc.); in these, fluorine is, by means of the organic matter, combined with phosphorus in the proportion of one four-hundredth part and sometimes less. The constancy of its presence in cells possessing intense life shows that it must play an important part in their function.

In order to study the influence of fluorine on plants, the writer and his collaborator commenced in 1913 numerous field experiments with entirely artificial soils almost completely wanting in fluorine, using as controls the same soils with added fluorine, and common soil. They thus observed that fluorine in some rare cases exerts an inhibitive action, but that in most cases it renders vegetation, flowering and the production of seeds more active. With certain species of *Sinapis* a much more rapid and greater development of the plant was obtained in soil containing fluorine than in the same soil free from it; in the former cases the production of seed was nine times greater than in the latter. Other plants benefiting by the presence of fluorine are: *Eschscholtzia*, hemp, cabbage, vipers-bugloss (*Echium*). For wheat, rye, oats, corn-flower (*Centaurea cyanus*), and cress, the action of fluorine is doubtful and occasionally injurious, at least under experimental conditions.

366 – **The Oxidases in Healthy and Curly Dwarf Potatoes.** — Bunzel, H. H. (Chemical Biologist, Plant Physiological and Fermentation Investigations, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. II, No. 5, pp. 373-403. Washington, D. C., August 1914.

The oxidase activity of the foliage of normally developing potato plants is greatest in the early stages of development, but falls off with the growth of the plant and rises again when growth ceases. Plants infected with the curly dwarf disease ("curly top", or Blattrollkrankheit) show a greater oxidase activity than healthy ones of the same age, in the juice of both their tubers and their foliage.

Assuming that the intensity of the oxidation processes in the cells depends upon the concentration of the various oxidases present, the diseased plants would appear to be in a condition corresponding to "fever" in animals. These results agree in their general nature with those of Bunzel on curly-top of sugar-beets and of Doby on leaf-roll of potatoes. In all these cases an increase of oxidases and a general retardation of growth are found.

The physiologically more active parts of the plants, such as the leaves, furnish juices with greater oxidase activity than the obviously less active portions such as the stems. There is therefore reason to believe that the rate of respiration is affected by the quantity of oxidases present and that the dwarfed potato plants have a higher rate of respiration than healthy plants. Experiments are being planned to determine this.

367 - **The Changes in Composition of Peel and Pulp of Ripening Bananas.** — GORE, H. C. (Chemist in Charge, Fruit and Vegetable Utilisation Laboratory, Bureau of Chemistry) in *Journal of Agricultural Research*, Vol. III, No. 3, pp. 187-203. Washington, D. C., December 1914.

Four series of experiments were made. In two, bunches of green bananas were ripened in a large respiration calorimeter designed for experiments with man. In the third and fourth experiments studies were made in a specially designed ripening chamber, of the uniformity of ripening in different bunches and of the rate of starch hydrolysis during ripening in relation to changes in the rate of respiration. Green bananas were obtained from commercial shipments just received from the West Indies.

The most conspicuous change during the ripening process is the long recognised conversion of starch into sugars, which is most rapid while the fruits are turning from green to yellow. During this period the rate of respiration increases manyfold, becoming greatest at the time when the rate of starch hydrolysis is most rapid. Starch hydrolysis then gradually slackens, later ceasing altogether. The rate of respiration also decreases, but still remains far more active than in the green fruit.

Important changes in the moisture content occur. The peel loses water while the pulp steadily gains. The respiratory quotient and thermal quotient indicate that the carbon dioxide evolved on normal ripening is due solely to the complete combustion of carbohydrates. The water formed in respiration can therefore be calculated from the quantity of carbon dioxide evolved. Some of this water is absorbed by the pulp during the hydrolysis of the starch, and when the fruit becomes over-ripe there is an excess of water produced over that required for hydrolysis. The development of the sugar content of the pulp raises the osmotic pressure, which probably accounts for the transference of water from the skin to the pulp.

The quantities of ash, protein, and ether extract underwent but slight changes during the ripening of the benanas. There was a marked decrease of pentosans in the pulp, but little change in the peel.

368 - **Electrical Injuries to Trees** (1). — STONE, GEORGE E., in *Massachusetts Agricultural Experiment Station Bulletin* No. 156, pp. 19 + 14 figs. + 5 plates. Amherst, Mass., October 1914.

Besides the matter contained in a previous bulletin on electrical injury to trees issued by this Station, the present bulletin contains the results of new observations.

Both alternating and direct currents are used and they produce different physiological effects on plant life; the former seem less injurious than the latter, and when either is used at a certain amperage it acts as a stimulus to the plant, and growth and development are accelerated. The optimum current is about 0.2 milliamperes; beyond this, retardation of the plant activities is produced and at a certain point the maximum is reached

(1) See also *B.* June 1911, No. 1788. (*Ed.*

which causes death. The maximum current necessary to kill a plant is very variable.

The direct current has a less stimulating effect than the alternating one and, on account of its electrolysing effect, is capable of causing more injury to vegetable life than the alternating current. Some facts would seem to show that trees may be killed by this action by a direct current of insufficient intensity to burn them.

Most of the injury to trees from trolley or electric-light currents si local: *i. e.*, the injury takes place at or near the point of contact of the wire with the tree. This injury is done in wet weather when the tree is covered by a film of water, which provides favourable conditions for leakage. In a large number of tests, the writer never found any leakage during fair weather.

The electrical resistance shown by trees varies considerably with the surrounding temperature and is therefore different at the east, south, west and north sides of the trees.

With a length of 10 feet and diameter 2 feet, and electrodes 10 ft. apart, the lowest electrical resistance obtained from the maple (*Acer saccharum* Marsh) was 14 000 ohms, and the highest 33 000 ohms; those obtained from the elm (*Ulmus americana* L.) were 6 300 and 29 400 respectively. These resistances are relatively low, as in cold weather they often exceed 100 000 ohms. The lower resistance in all cases corresponds to periods of high temperatures and the highest to periods of the lowest temperatures. The resistance given by small tree trunks and woody stems, even for small distances, is quite large. About 4 feet of a young pear tree, including the root system, gave a resistance of about 300 000 ohms, and the resistance given by a tobacco plant, in which the distance between the electrodes was only 14 inches, was much higher (110 000 to 165 000 ohms) than that shown by most trees at corresponding temperatures.

There is considerable difference in the electrical resistance of various trees, as well as of their different tissues; generally it is least in the cambium, that is in the tissue containing living cells; it is greater in the sapwood, and probably greatest in the heartwood. The outer bark seems to offer the most resistance, especially when dry. It is, however, not unlikely that the resistance of the various tissues may vary in some species.

The electrical resistance of trees is so high that it is doubtful whether injury ever occurs to them from contact with low or even high tension wires except that produced by grounding when the bark is moist. Any escaping current from transmission lines that can be transmitted even through the least resistant tissues is likely to be insignificant. The high electrical resistance of trees in general is a protection also in case of lightning strokes. In a much greater number of cases than is realized, trees are struck, during storms, not in the usual way but by earth discharges; as a rule one side of the trunk and one or more of the limbs are affected and sometimes killed.

The writer has never observed any authentic case in which an alternating or a direct current caused the death of a tree, but cases are known in

which death resulted by the " reversed polarity ", that is when, on electric railroad systems, the rail was positive and the overhead wire was negative.

The burned areas are greater about the positive electrode than about the negative one, and in the case of reversed polarity the opportunity for extensive burning is much greater. The burning is caused by the intense heating of the film of water and water-soaked bark, which destroys the underlying living tissues.

PLANT BREEDING

369 – **Report on the Selection of Barley at Svalöf from 1911 to 1914.** — TEDIN, HANS, in *Sveriges Utsädesförenings Tidskrift*, Year XXIV, Part 6, pp. 339-366 (Summary in German, pp. 367-371). Svalöf, 1914.

At Svalöf during the four years 1911-14, 51 different kinds of two-rowed barleys were subjected to comparative tests. With the exception of five, these varieties were produced at Svalöf in pedigree cultures. Twenty-one of them were gradually eliminated. One (No. 0125 of the genealogical register), produced by a local breed from Scania, gave an average yield over eight years of 178 lbs. of grain per acre more than the well-known Svalöf Prinzessin, and beat it also in size of grain, resistance to lodging and earliness; it had, however, to be eliminated for the defective shape of the grain and for a suspected tendency to have empty spaces in the ear (owing to abortion of the spikelets).

Some of the most promising selections of 1914 are the following:

No. 0412, which belongs to the δ type (rachilla with woolly hairs, and flowering gloom with the inner pair of veins toothed), was obtained from a mixed sample of common Chevalier barley. It gave an average yield, in the three years 1911, 1913,1914 (1912 is not considered, because the experiment plots failed that year) of 1.8 per cent weight of seed more than Prinzessin, and an average for eight years of 3.9 per cent more than the latter; it is superior also for size of grain, bushel-weight, earliness, and strength of straw; but it is inferior to Svalöf Golden for productiveness; for its general characters it is not suitable as a substitute for Svalöf Golden, but for Prinzessin.

No. 0157 is an α type obtained from another mixed sample of common Chevalier barley: for its general characters it is adapted to the conditions of soil and climate that suit Prinzessin.

No. 0166 and 0169 are both α types, obtained, one from a mixed sample of barley from France, the other from a similar sample from Scania. The grain of No. 0169 has an extremely thin tegument, but it will probably have to be discarded on account of the elongated shape of the grain and consequent low bushel-weight. Both these barleys have given good yields. Probably they are not authentic old local varieties, but mixed forms of Prentice, an originally English variety to which Prinzessin in part owes its origin.

For selection, the separation of forms (from old local types or mixtures) was supplemented by artificial hybridisation. Two mixed strains from Scania have been dealt with and three more are now being treated. The treatment is as follows : The seeds of any number, not inferior to 100, of different plants are sown the first year in a plot called the general plot

(Gesammtparzelle). The seeds are put in, one by one, with a marker two inches apart, in rows 6 inches apart. Every row of this plot corresponds to a "biotype" or "pure line" or "pedigree". In the succeeding two or three years the seed obtained from each row is sown, with a marker, in separate plots called "check plots", which measure 5 ft. × 10 ft. The plants are pulled up with their roots, and those from the two outside rows of the plot are kept apart from the others, which constitute the "normal plants". Every year some of these normal plants perfectly free from injury are used to determine the average weight of the plant; others are used to determine the percentage of seed. The selection is based on the numerical data thus obtained, as well as upon the shape and size of the grain, on the corrugations of the seed integument, on the bushel-weight, and on the observations made during the period of vegetation as to the time of ripening, on the strength of the haulm, etc. Thus the number of lines is always diminished; in 1914 it was reduced for one of the above barleys to 18, and for the other to 43.

The above-mentioned crosses were made in 1908. For them a greater number of characters is recorded, namely: time of ripening, rigidity of straw, aptitude of the ears for issuing from the last leaf-sheath, inclination and density of ears, hairiness of rachilla, presence of teeth on the veins of the flowering glume, colour of seed before ripening, etc. All these characters appear well individualised as regards heredity and separate and combine independently of each other, as was already known for some of them. For several of these constants the writer obtained combinations which were transmitted unchanged.

By means of the cross Svalöf Chevalier II × Svalöf Golden it was sought to give the latter the greater size of grain possessed by Chevalier, an increase in the yield of grain and straw and a better conformation of the seed envelopes. Of this cross three numbers or lines were sown in the F_2 (1910) generation. One of these was followed by reproducing in 1911 one hundred plants of it on different plots; of those of the F_3 generation which showed constant hairiness of the rachilla, 32 were sown in 1912 (F_4 generation) on check-plots from which 109 F_4 pedigrees were obtained. Eight of the controls were reproduced in 1913 (F_5 generation) and of these 7 discarded and one passed to the test on a large scale in 1914. This affords a very fine example of a descendent of a cross which is superior to the parent forms in the characters inherited from them: it surpasses them in late ripening and in the more erect ears. Of the 109 F_4 pedigrees of 1912, 96 in which the rachilla was constant were reproduced in 1913 on check plots; 16 of them were sown again in 1914 (F_6 generation) and 12 of these were also multiplied in order to get seed for the large-scale tests. Most of the descendants proved constant in the field.

The same method was applied to the crosses Prinzessin × Chevalier II; Golden × Hannchen, and Primus × Chevalier II.

Since 1911, a mass or promiscuous sowing has been carried out every year for each hybrid. After some years (one may say 7 or 8) the greater portion of their sub-forms have become constant; in other words the

crosses have been transformed into populations of biotypes, which for the most part are constant. It is proposed further on to subject these populations to the separation of forms as is done with the old mixed strains.

Of the four-rowed barleys, 25 different varieties were submitted to tests on a large scale during the four years. Ten of these were gradually discarded. The selection of four-rowed barleys has been chiefly directed to the separation of forms in the old local races of Scania.

Both in the pedigree culture (that is in the first generation offspring of a plant) and in the large-scale or preparatory cultural tests, the parent strains or the parents are always tried alongside of the offspring of the various generations.

370 -- **A More Accurate Method of Comparing First Generation Maize Hybrids with their Parents.** — COLLINS, G. N., in *Journal of Agricultural Research*, Vol. III, No. 1, pp. 85-91. Washington, D. C., October 1914.

So large a proportion of first-generation maize hybrids have been found to give increased yields and the increase is frequently of such magnitude that the utilisation of this factor of productiveness becomes a practical question. It is therefore highly desirable to understand the reasons why some crosses give favourable results and others give little or no increase over the yield of the parents.

In making a comparison between a hybrid and its parents it is difficult to obtain seed that truly represents the parents, since environment has a direct effect on the yielding power. Differences also occur between the individual plants that produce the hybrid seed and those producing the pure seed which is to represent the parental varieties. These differences may be eliminated by averaging large numbers of plants, but this method obscures the point under investigation. The sources of inaccuracy due to cross-pollination may be avoided in the following method. Two plants of each variety are selected, thus, A_1, A_2, and B_1, B_2. Hand pollinations are made as follows: $A_1 \times A_2$, $A_2 \times B_1$, $B_1 \times B_2$ and $B_2 \times A_1$. The result is two hybrid ears and one cross-pollinated pure ear of each variety. Thus, by making two hybrids involving all the plants used in producing the pure seed ears, individual differences that affect the yielding power of the pure seed ears are similarly represented in the hybrids.

To secure the most accurate comparison of the yield of the four ears, one seed from each of the ears was planted in each hill. At harvest the seed from each plant was weighed and recorded separately, all hills that lacked one or more plants being excluded. The mean yield of the four kinds in each hill was determined, and the yield of each of the four plants was stated as a percentage of this mean.

This method was applied to a cross between Egyptian, a white sweet corn, and Voorhee's Red, a sweet variety with red aleurone, with the following results :

Variety	Yield	Height
	per cent	per cent
Egyptian	112.8 ± 4.6	111.3 ± 1.0
Voorhees' Red	55.6 ± 4.0	84.0 ± 0.9
Hybrid 1.	89.0 ± 5.1	100.0 ± 1.2
Hybrid 2.	142.8 ± 4.3	103.6 ± 1.1

Thus the mean yield of the hybrids is 31.7 ± 4.5 per cent higher than the mean of the parents, and this increase is ascribed to the effects of crossing. A striking feature of the result is the difference between the two hybrid ears, which amounts to 53.8 ± 6.7 per cent.

This experiment is also a test of the method of comparison by individual hills. When the yield of each plant was compared with the average of all the plants of the same kind, the coefficient of variability was 5.42 ± 0.17, and when it was compared with the mean yield of the hill in which the plant grew the coefficient of variability was 5.05 ± 0.13, thus showing a slight gain in accuracy, notwithstanding the exceptional uniformity of the soil on which the experiment was carried out.

371 – **Albinism in Maize: A Genetic and Cytological Study.** — MILES, F. C. (U. S. Department of Agriculture) in *Journal of Genetics*, Vol. IV, No. 3, pp. 193-214 + 2 plates. Cambridge, England, February 3, 1915.

Experiments on albinism in maize were begun at the Nebraska Agricultural Experiment Station in 1912.

Crosses were made between green, yellowish-white, green-striped, golden (a variety green in the seedling stage but later turning yellowish) and *Zea japonica* (striped).

From the study of the various categories it appears that in all cases, with the possible exception of the striped leaves of *Zea japonica*, the several degrees of albinism in maize leaves behave as simple recessives, the first generation of a cross with ordinary green races giving fully green plants, and the second generation segregating in the ratio of three green plants to one plant of the particular type used in the parent cross.

A definite relation has been pointed out between a pure white type of maize plant and a yellowish-white type, the results indicating that the presence of at least two factors is necessary for the development of normal green in the leaves of maize. In the absence of one of these factors the plant is pure white and soon dies, while in the absence of the other factor the plant is at first yellowish-white, but is capable of developing into a greenish condition and sometimes becomes a pure green plant. Apparently there is some genetic factor (or factors) which is concerned in the development of chlorophyll, and, since the F_1 generation between green-striped and golden plants is always green, the factor which is lacking in

one parent may be present in the other. Histological examination of the leaves showed the entire absence of plastids from pure white plants. In the yellowish-white plants which later may become green, plastids are present from the first, though few in number, and gradually increase in number and size as the leaf turns green.

372 – **Wheat Improvement in Australia.** — GUTHRIE, F. B., in *Department of Agriculture, New South Wales, Science Bulletin*, No. 11. pp. 131. Sydney, October 1914.

I. DISCUSSION OF THE PROBLEMS INVOLVED, AND SOME OF THE RESULTS OBTAINED. — The result of the interstate conference of 1890 which was called to deal with the question of combating rust, and at which the agricultural Departments of all the States were represented, was to give an impetus to the systematic study of the wheat plant with the special object of improving the grain itself and the methods of soil treatment and crop production.

Before this concerted official action there had been a great deal of good work done by private individuals, among whom Mr. WM. FARRER (1) stood foremost:

The specific points to which attention has been more particularly directed in the production of improved types of wheat have been the following.

1. Immunity against rust and other diseases.
2. Prolificness.
3. Drought resistance.
4. Improvement of milling qualities.
5. Creation of wheats for hay.
6. Creation of wheats for different districts.

1. *Rust resistance.* — The characters which confer rust-resistance locally are by no means identical with those which are required in other countries.

The disease itself exhibits certain characteristics which differentiate it from European or American rusts. Of the three kinds of rusts which attack the wheat plant, namely *Puccinia graminis* or black rust, *P. dispersa* or brown rust, and *P. glumarum* or yellow rust, the only one that is destructive in Australia is *P. graminis*; the second does not occur in Australia and the third does little or no damage.

A great deal of work in the direction of selecting and testing rust-resistant varieties has been done at the Hawkesbury Agricultural College near Sydney. Though this is not a wheat-growing district, it is very subject to rust and was on this account chosen by Mr. FARRER as the most suitable place for testing his rust-resistant crosses. Of these, Warren and Thew proved the most resistant. Other Farrer wheats, such as Florence, Firbank and Bunyip, are also successful on account of their maturing early. Bobs was grown succesfully for several years, but it ultimately lost its rust-resisting properties.

(1) See also *B.* Feb. 1915, No. 164. (*Ed.*).

2. *Proliferness.* — The yield of wheat in Australia never reaches the maxima that it attains in Europe. The highest individual yield of which the writer can find any record as being obtained from a reasonable area, is one of 43 bushels. The highest average yields were in Tasmania, 25 bushels per acre in 1912-13, where, however, the area under wheat is very small; the average yield for any State rarely exceeds 14 bushels. The question of prolificness is closely bound up with that of drought-resistance. Mr. H. PYE, the Principal of Dookie Agricultural College, summarises the characters which make for prolificness in a wheat under Australian conditions, as follows: Well developed root system; strong tillering or stooling property; long ears; dense or close ears or an increased number of spikelets per ear; increased number of fertile florets per row of spikelets; large and heavy grain. Wheats with these characters are the most likely to withstand droughty conditions.

3. *Drought resistance.* — A good example of what may be achieved in the cultivation of wheat in dry areas with suitable varieties is afforded by Mr. MC ALPINE'S experiments at Mallee in 1900.

The total rainfall for the year was 13.24 inches, of which only 7.38 in. fell during the growing period (April-October). The average yield for the district was about 5 bushels. The average from the experiment plots, one acre each, was 18 bu. per acre. The wheats that yielded best were Queen's Jubilee Outpost and Improved Allora Spring; these all gave over 20 bushels.

4. *Milling quality.* — The Australian miller produces practically only one grade of flour a straight grade, and blending, as understood in other countries, is unknown. The most striking successes in the production of wheats of high milling excellence are due to Mr. FARRER. Many of his most popular wheats such as Federation, were crosses between local weak-flour favourites and strong-flour wheats of the Fife family. The Farrer wheats are all distinguished as good milling wheats, and in addition he has created new types of specially high flour-strength, principally by admixture of Fife and Indian blood. This type, represented by wheats like Bobs and Comeback, and still more Cedar, yields flours equal in strength to any on the market. This season some samples of Cedar have gone up to 67½ lb. per bushel. It is also remarkably rich in gluten, averaging about 15½ per cent dry gluten.

II. THE IMPROVEMENT OF WHEATS IN THE DIFFERENT STATES OF THE COMMONWEALTH. *New South Wales.* — At Cowra at present more attention is paid to selection from existing crosses than to the creation of new ones.

Among the drought-resistant wheats, Sunset is considered as the most promising. It is a cross between a sport from Blount's Lambrigg and a cross between White Fife and Summer Club. It is one of the earliest ripening kinds and amongst the most prolific in dry ditricts.

Three new wheats have been distributed in 1914: Bomen, bunt-resistant; Canberra, early, prolific and yielding a high percentage of excellent flour, but weak in the straw; Nardoo, smut-resistant.

Victoria. — Systematic work in the improvement of wheats by se-

lection combined with cross-breeding is carried out at the Government Experiment Farms and Stations. At Dookie the following wheats have been produced: Improved Steinwedel, drought-resistant, prolific and with the merit of holding its grains well; Warden, which was specially selected for its hay-producing qualities and is still the most popular hay wheat in Victoria; College Purple and Wallace, the latter being specially suited for cooler districts; Commonwealth; Currawa, a high yielder; Major; Yandilla × Red Bordeaux; Maira.

The work of selection and cross-breeding forms the principal feature of the experiment stations at Werribee (Central Research Farm), Rutherglen Experiment Station, and Longrenong Agricultural College. The plan adopted is the "centgener" test plot system (1). Comparison was made last season of the yields of twenty standard varieties from plots sown with seed subjected to this method of selection with yields from the same varieties unselected, and the former was found to be greater by 3 ½ to 13 bushels, and it is anticipated that the adoption of this system will make it possible to increase the prolificness of the standard varieties by at least 20 to 25 per cent. At Rutherglen some cross-breds have been produced which give yields as high as 45½ bushels to the acre.

Two new varieties of particular promise have been obtained by crossing Federation with Indian F (a beardless, compact, early-maturing type obtained from Pusa). A large number of crosses have been made between standard Australian varieties with Manitoba and with Russian hard red wheats.

South Australia. — South Australia was the first of the States to undertake the systematic improvement of wheat. The first grain that was selected was Ward's Rust-proof or Ward's Prolific; it is rust-resistant and highly prolific and is the parent of all the principal varieties that made wheat growing profitable in South Australia. Among these some of the best known are Marshall's No. 3, Marshall's Prolific, Silver King, Majestic; all of them are due to Mr. RICHARD MARSHALL and are highly popular. Yandilla King is another one of his productions; it is a cross between Yandilla (Farrer) and Silver King (Marshall); Mr. INGLIS and Mr. LEAK selected two rust-resistant varieties that are still widely grown.

The activity of the South Australian Department of Agriculture is represented especially by the work of Professor A. J. PERKINS, who bases his method on the assumption that selection to be effective must be continuous and uninterrupted. From the "selection plots" the best ears are selected and are used for the following season's selection plot and so on. Some of the wheats have been selected in this manner since 1904. In the selection plots the picked ears are sown in rows 24 inches apart, each grain being dibbled in one link apart. Each ear is maintained separate under a number or letter, so that there are always several strains of the same variety, many of which are discarded in the course if time of they do not

(1) See *B.* Jan. 1915, No. 29. (*Ed.*)

come up to expectations. In the same way all the the wheats are strictly pedigreed and can be traced back. In picking out the best ears attention is paid to the usual points: The plants must be thoroughly satisfactory, well grown; the size and conformation of the ears; the absence of empty shells; the number of spikelets; the number and size of the grains, which are always hand-graded before sowing. After picking the best heads for the next year's selection plot, the remaining plants are stripped, and the grain goes into the "seed plots" extending over half an acre to 2 or 3 acres. In the following year these seed plots supply the farm seed and in the year after that the seed is available to outsiders. By these means the seed supply is constantly being renewed by recent selections.

Western Australia. — Among the best cross-bred wheats obtained by Mr. G. F. BERTHOUD and which are still popular in Western Australia the best known are:

Alpha and Crossbred No. 73, early wheats especially adapted to the drier districts; Zealand, essentially a hay wheat; Lott's or Gregson's and Penny's, each originated from a single ear and very prolific. Le Huguenot is particularly valuable as a hay-wheat; it is beardless, and originated from a single plant.

Mr. CORRELL has also been successful in fixing a number of promising varieties from single plants apparently produced by natural cross-fertilization.

Mr. GRASBY aimed at creating early-maturing varieties possessing stiff straw, and hay wheats. In this latter respect very promising results have been obtained by using Huguenot as a parent. He has placed at the disposal of the Education Department the produce of his own experimental plots in order to promote the study of wheat growing in schools. In conjunction with Mr. E. A. MANN he has studied the effect of manuring on the milling quality of wheat. The results obtained would seem to indicate that the addition of potash, and in a lesser degree, of lime, to the crop increases both the gluten content and also the water-absorbing power of the flour obtained.

Queensland. — The Agricultural College at Gatton and the State Farms at Roma, Hermitage and Giudie are all engaged in wheat culture. In all the wheat-growing districts of Queensland farmer's, experiment plots have been established. Thus Queensland, though not a wheat State, has not neglected to provide for the improvement of this cereal.

373 – **The Use of Seed-Potatoes from Light Soils for Richer and Heavier Soils.** — SCHNEIDEWIND, in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen*, Year 17, No. 3, pp. 18-19. Halle, January 16, 1915. AGRICULTURAL SEEDS

In order to ascertain the increase in yield which could be obtained by planting good and heavy soils with seed-potatoes from sandy land, some varieties which had been grown on the loess-loam soil of the Lauchstädt Experiment Station were planted in the sandy soil of the Gross-Lübars Experiment Farm; seed potatoes from this crop were returned to the Lauchstädt Station and there tested in comparison with others grown there.

In the years 1910 and 1912, the increased yield per acre due to the change of seed-potatoes amounted to 4 000 to 4 150 lbs. of potatoes, or 570 to 855 lbs. of starch. In 1913, in the case of one variety the increase was 2000 lbs., or 505 lbs. of starch, and with another 7 100 lbs. of tubers, or 1500 lbs. of starch.

As the figures show, the seed-potatoes that were taken back from the sandy soil produced considerably heavier crops than those which had been grown on the heavier land at the Lauchstädt Station itself.

CEREAL AND PULSE CROPS

374 – **The Classification of Common Millet *(Panicum miliaceum).*** — SIRIONSOFF, M., in *Selskoie Khosiaistvo i Liesovodstvo*, Vol. CCXLVI, pp. 546-573. Petrograd, December 1914.

Although millet has been cultivated since ancient times, it has been the subject of very little careful study. In Russia, where it occupies about 3 per cent of the total area of arable land, it is only recently, with the progress and perfectioning of plant breeding, that its extensive study has been commenced on a scientific basis.

Classification of Panicum miliaceum.

Group I: *effusum*, with loose panicle.

Variety	Colour of grain	Variety	Colour of grain
1. *coccineum*	red	8. *subcinereum*	grey
2. *subcoccineum*	»	9. *luteolum*	yellow
3. *aureum*	bronze	10. *subluteolum*	»
4. *flavum*	cream	11. *subaureum*	bronze
5. *subflavum*	»	12. *fulvastrum*	greenish-yellow
6. *candidum*	white	13. *sublaetum*	orange-red
7. *cinereum*	grey	14. *badium*	light auburn

Group II: *nutans*, with drooping panicle.

15. *sanguineum*	(a) *	red	23. *victoriae*		with yellow sides
16. »	(b)	»	24. *atrocastaneum*	(Btln)	dark auburn
17. *subsanguineum*	(a)	»	25. *griseum*		grey
18. »	(b)	»	26. *subgriseum*		»
19. *aureum*	(a)	cream	27. *luteum*		yellow
20. »	(b)	»	28. *subluteum*		»
21. *subaureum*		»	29. *fatyx*		bronze
22. *album*		white			

* Grains of varieties (*a*) are larger than those of (*b*).

Group III.: *compactum*, with compact panicle.

30. *dacicum*	red	33. *rubellum*	cream
31. *subdacicum*	»	34. *alefeldi*	bronze
32. *densum*	yellow	35. *dshuruniensis*	grey

Varieties studied by KOERNICKE, BATALINE and SABANINE.

36.	Group	I	var. *nigrum* (Kcke)	black
37.	»	I	» *subnigrum* (Kcke)	»
38.	»	II	» *atrum* (Kcke)	»
39.	»	II	» *leptodermum* (Btln)	white
40.	»	II	» *subleptodermum* (Sbn)	»
41.	»	II	» *ochroleucum* (Btln)	grey-yellow
42.	»	III	» *metzgeri* (Kcke)	grey

The writer's studies were undertaken on the experimental field at Temir (Caucasus) on 80 plots of about 10 sq. yards each. Some interesting observations were made on the fertilisation of the plant. The process is effected in 27 minutes, of which about 19 minutes are required for the opening of the pales and the extrusion of the stamens; during the remaining 8 minutes the style exhibits its maximum tension, with the result that the stigma is directed towards the stamens. As the stigma is about to reach the stamens, the anthers dehisce and pollination occurs. After fertilisation the turgescence of the tissues diminishes, and after 5 minutes the flower closes. Fertilisation occurs most vigorously between 11 a.m. and noon on sunny days, and it is quite a normal occurrence for 40 to 55 flowers to be fertilised in 3 or 4 minutes. During cloudy and rainy weather fertilisation is delayed and requires a longer period.

A study of the structure and fertilisation shows that self-fertilisation is the rule in millet and that cross-fertilisation, if it is possible at all, only takes place in the case of an unusual combination in the structure of the upper and lower flowers of the same spikelet.

With regard to the characters of millet, the form and colour of the panicle and the colour of the integument of the grain constitute a sound basis for classification. Since most varieties of millet have either pale yellow or violet coloured panicles, the prefix " sub " in the classification is used to designate varieties which differ only in the violet pigmentation of the panicle, the colour of the grain remaining the same.

375 – **The Effect of Ferrous Sulphate on the Yield of Potatoes.** — EDWARDES-KER, D. R., in *The Journal of the South-Eastern Agricultural College, Wye, Kent*, No. 22 pp. 353-358. London, and Ashford, Kent. STARCH CROPS

As the result of experiments carried out in both garden and field during the year 1912, it was found in each case that the application of ferrous sulphate as a top-dressing to a potato crop at the rate of ½ cwt. per acre led to no measurable increase in the crop and to no appreciable change in the quality of the tubers obtained. These results, which are in direct contradiction to those obtained by other investigators, were ascribed to the unusually large percentage of lime in the experimental soils; the experiments were therefore repeated in 1913 on a soil poor in lime. Two areas, each of which was made up of eight $^1/_{40}$ acre plots, were set out in a potato field; in each area four of the plots were used as controls while the other four received dressings of ferrous sulphate at the rate of ½ cwt. per acre

in the one case and 1 cwt. per acre in the other. The resulting crops were as follows :

	Dressings of ferrous sulphate	
	½ cwt. per acre	1 cwt. per acre
	lbs.	lbs.
Total tubers from untreated plots.	2 903	2 910
» » » treated »	2 859.5	3 418
Average difference per plot	10.75	127
Probable error of average difference	± 23	± 49

Where only ½ cwt. of ferrous sulphate was applied per acre, the dressing had no effect on the crop obtained, but where 1 cwt. was applied the treated crop was distinctly larger than the untreated.

FIBRE CROPS

376 – **Description of Standard Grades of Abaca (Manila Hemp) adopted in the Philippine Islands.** (1) — I. EDWARDS, H. T. (Director of Agriculture): The Standardisation of Abaca. — II. SALEEBY, M. M. (Chief, Fibre Division): Description of the Standard Grades of Abaca (Manila Hemp). — *The Philippine Agicultural Review*, Vol. VII, No. 10-12, pp. 371-390 and 402-410. Manila, P. I., December 1914.

I — STANDARD GRADES OF ABACA.

The increasing production of machine-cleaned sisal fibre of standard quality is resulting in a gradual substitution of abacá fibre, which is produced in a large number of grades of quality, much to the detriment of the Philippine Abaca industry. This competition has become so serious that the Government of the Philippine Islands have introduced Legislation which will take effect on January 1, 1915, establishing a system of Government standardisation and inspection. This act, known as the " Fiber Inspection Law ", provides for the inspection, grading and baling of Abaca (Manila Hemp), Maguey (Cantala), Sisal and other fibres. The regulations cover three main subjects, namely : *a*) designation of the official standard grades for each fibre ; *b*) determination of the standard grades and types thereof ; and *c*) additional regulations regarding baling and labelling.

A. Designation of official standard grades.

1) Abaca (Manila hemp) — Well cleaned fibre : 9 grades.
2) Abaca (Manila hemp) strips — Partially cleaned fibre : 4 grades.
3) Maguey and sisal — Retted : 3 grades.
4) Maguey and sisal — Knife or machine cleaned : 3 grades.
5) Pacol or wild banana : 2 grades.

B. — Determination of grades.

The above grading, with the exception of abaca strips, is to be based chiefly on *colour* and *strength*. Colour will reman the main basis of classification and the extent of variation

(1) See also *B.* Feb. 1914, No. 124; *B.* March 1915., No. 243. (*Ed.*)

allowable will be determined by comparison with standard samples. The fibres must possess a certain minimum of strength irrespective of their colour ; otherwise they are classified as damaged. The methods of cleaning or fibre extraction produce such radical changes in the character and usefulness of the fibre, that separate sets of standard grades are adopted. Thus the methods of preparation are not considered in the actual grading.

Variations in the texture, size, or length of the abaca fibre will not affect its grade. They may be considered an advantage or disadvantage according to the nature of the uses to which the fibre will be put. These differences therefore produce variations in the type of the fibre but not essentially in its grade. The *texture* is designated as " soft " or " hard " ; the *size* as " fine " or " bold " ; the *length* as " long " if exceeding 8 feet (2 ½ metres), " normal " if between 5 and 8 feet (1 ½ to 2 ½ metres), " short " if between 4 and 5 feet (1 ¼ and 1 ½ metres), or " very short " if less than 4 feet (1 ¼ metres). These measures are approximate and are taken from the head of the hank to within 15 cm. (6 in.) from the tips. To facilitate the division into lots uniform in type, the abaca provinces are divided into districts, the products of which may be considered by the grader as uniform in type.

C. — *Baling and labelling.* — The following regulations are imposed :

1) Each hank in a bale shall not exceed 12 cm. (4 3/4 in.), nor be less than 6 cm. (2 3/8 in.) in diameter before pressing.

2) The dimensions of each bale of the grades " Extra prime ", " Prime " and " Superior current " may not exceed by more than 30 per cent the measurements of Section 5 (*a*) of Act 2380 (1).

3) The hanks may only be twisted once or twice, sufficiently to keep the fibres together.

4) The hanks shall be laid straight in the bale, the heads in one row alternating with the tips of the next row ; they must not be doubled more than is absolutely necessary.

5) Each bale shall be securely bound with not more than eight side and four end bands.

6) The fibre on being graded shall be divided into lots which shall be of uniform type, but may be of more than one grade. A separate certificate of inspection must be given for each lot.

7) Each bale shall bear two tags, one of tin and one of russet strap-leather each 12×6 cm. (4 3/4 × 2 3/8 in.) connected by a piece of wire 50 cm. (20 in.) long.

II. Description according to Colour and Cleaning.

Brown. — This is the lowest grade for well cleaned fibre. The fibre is usually coloured brown or dark red, mixed with light purple or light burnt sienna, the latter being prominent towards the tips. It generally consists of fibre obtained from the outside sheaths of the stalk, which in some vareties are of a dark colour. It rarely exceeds 5 feet (1 ½ metres) in length. It may also consist of fibre originally of a better grade, but which, owing to neglect and exposure, has become darkened : in this case the fibres are much longer. The texture of this grade is either " soft " or " medium ", depending upon the degree of cleaning.

Seconds. — This is the next highest grade for well cleaned fibre. The colour is usually light brown or light red mixed with yellow ochre in variable proportions. The part from the middle to the tip is usually darker. This fibre is obtained from the sheath next to the outside sheath of the stalk and being only partially covered by the latter, the fibre has a spotty or " streaky " appearance. Local injury to the stalk may also produce the same effect. The length of the fibre is about the same as for the preceding grade.

Current. — This is the most important of all grades of abaca, owing to the extent of its supply and the demand for it for cordage purposes, rather than for its superior quality. Owing to its commercial importance and to the fact that it has been the basis for the determination

(1) See *B.* March 1915, No. 243. (*Ed.*).

of the higher grades, a thorough knowledge of its characteristics is of special importance. In colour it is very light brown or red, approaching light ochre, without the streaky colour characteristic of the inferior grades. The colour is caused chiefly by the action of the acid remaining after incomplete drying and cleaning. This grade is obtained from the third group of sheaths in the stalk, which are generally thicker than the inner sheaths and possibly contain a larger amount of sap. Two types of texture are recognised — soft and hard. Soft fibres are characteristic of certain districts, though the texture is to some extent affected by the method of cleaning.

Midway. — This is a medium grade between the current and the good current. The predominant colour is light ochre. In this and the succeeding grades the presence of partially cleaned strips is a serious drawback, as it is in these grades that the mostprized characteristics of the abaca fibre are exhibited.

Good current. — This is the highest grade of the second group, and its predominant colour is a very light ochre interspersed with small quantities of fibre of an ivory yellow or white colour. The texture is generally softer and is determined entirely by the variety of the plant and the district of production. The production of this and the succeeding grades has declined considerably of recent years and is estimated at about 3 to 4 per cent of the total.

Superior current. — This is the lowest of the third or superior group of grades; its predominant colour is light ivory yellow, a considerable portion of which usually approaches white. In texture and length it resembles good current. Though the production is low at present, it is expected to increase in the future owing to the increased demand for it for braid purposes, especially in the Japanese market.

Prime and extra prime. — These grades resemble each other in most respects, the latter being only whiter in colour than the former. The texture is rarely hard. The best of these grades is produced in Cavite Province; it is usually of medium texture and possesses a rare lustre. Both the supply and demand for these grades is very limited, since they are only used for textile purposes.

Standard Grades of Abaca Strips.

These grades are determined not so much by the colour characteristic as by the width of the strips. The standard strength of these grades is also important.

Coarse brown. — This is the lowest grade. The strips are usually about 1 ½ to 2 mm. in width, of a hard texture, thick, and rough on the lower side.

Coarse. — Similar to the preceding in width and thickness, but of a lighter colour. These are probably of little use for cordage purposes and have no doubt injured the reputation of the industry.

Medium. — The average width is about 1 mm.; the under side is smoother and practically free from pulp. The colour is similar to the preceding but the texture softer.

Fair. — The average width is about 3 ^{3} $_{4}$ mm. to 1 mm., thinner and with less pulp than the preceding grades. In colour and importance it occupies a similar position to current among well-cleaned fibres. It is in particular demand on British markets.

377 – **Basket Willow Culture.** — LAMB, G. N. (Scientific assistant, Forest Service) in *U. S. Department of Agriculture, Farmer's Bulletin No.* 662, pp. 1-34. Washington, December 1914.

This account of willow culture comprises the selection of the ground, suitable varieties, propagation, manuring, harvesting and preparation of material, returns and market possibilities.

The varieties recommended are American green (*Salix amygdalina*) and Lemley (*Salix pentandra* L.), since they require little cultivation, are easily peeled and obtain good prices. The former is more suitable for

small beds where insect and fungoid pests can be controlled, and the latter for large beds, as there is less risk from epidemics. The purple willow (*S. purpurea*) produces high-class material, but it is only profitable where the cost of peeling is not high.

American green is of sturdy growth and yields an average of 6 to 9 tons per acre and under the most favourable conditions as high as 12 to 15 tons. It is in much demand by makers of furniture and of the heavier grades of basket ware. The Lemley (*S. pentandra minor*) and patent Lemley (*S. pentandra major*) grow best on loose sandy loam; clay soils should be avoided. They are comparatively free from disease but have a decided tendency to branch at the base. The average yield per acre is from 5 to 8 tons, 10 tons being sometimes obtained. Purple willows are useful for cordage purposes in tree nurseries and require steam peeling. The average yield is 5 tons per acre.

Caspian willows (*S. daphnoides* Vill.) produce fine tall, straight rods which are soft and split readily, but the yield is very poor. The Küstermann willow (*S. fragilis* × *triandra*) has been grown successfully, and, though comparatively free from branches and disease, it is of inferior quality.

378 – ***Ampelosicyos scandens* (Cucurbitaceae) a little-known Oil Plant in Madagascar.** — JUMELLE, H., and PERRIER DE LA BÂTHIE, H., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 4, pp. 144-146, Paris, January 25, 1915.

RUBBER, GUM AND RESIN PLANTS

Ampelosicyos scandens (Cucurbitaceae), called "voanono", occurs up to 800 m. (2600 ft.) in the Forests of Eastern Madagascar, growing in ravines where the wood is rather open and the soil rich in humus. It is a climbing plant, monoecious, with fruit somewhat obpyriform, 4 to 4 ½ in. long by 2 ¾ in. wide; this fruit contains, buried in its pulp, numerous seeds like large kidney beans. The natives consume both the pulp and the seeds raw; the latter are excellent roasted; they contain a sweet oil which the writers are investigating. It is probable that this species could be used as an oil-producing plant and it is stated that, when irrigated, it flowers and fruits in Imerina (Central Madagascar) still more freely than in the eastern portion of the island where it is indigenous.

379 – **Researches on African Rubbers.** — I. HEIM, F., CHENBVEAU, C., and MARQUIS, R.: Valeur industrielle de Caoutchoucs de "Gohine" du Haut-Sénégal-Niger. — II. HEIM, F., and MARQUIS, C.: Analyse de trois caoutchoucs de l'Afrique équatoriale française. — *Bulletin de l'Office Colonial*, Year 7, No. 84, pp. 497-500 and 500-501. Melun, December 1914.

CROPS YIELDING OILS, DYES AND TANNINS

I. — The "Gohine" liane (*Landolphia heudelotii*) is a source of rubber in French West Africa. Samples prepared by different methods of coagulation show only slight differences in their technological value. The writers have analysed two samples of this rubber from the Upper Senegal-Niger Region and give the data concerning the strength, extension, nerve, elasticity and permanent stretch of these two samples and of others from the same trees grown in different stations and prepared by various methods of

coagulation. Compared with Fine Hard Para they show a similar strength and greater resiliency and extensibility.

The writers also consider that the object to be sought for in " Gohine " rubbers is the combination of equal strength with a greater extensibility than that of Fine Hard Para.

II. — MM. HEIM and MARQUIS have analysed three samples of rubber from French Equatorial Africa, known as " Owouma noir " or " Andang " ; " Kondo " or " Pembé ", and " N' Cauli ". They were not able to determine their botanical origin, but the analytical and technical data show that " Owouma " rubber is interesting on account of its great chemical purity, comparable to that of Para. " Kondo " rubber also appeared to possess a fair technological value.

SUGAR CROPS

380 – **Some Difficulties in the Improvement of Indian Sugarcanes.** — BARBER, C. A., in *The Annals of Applied Biology*, Vol. I, Nos. 3 and 4, pp. 211-221, + figs. 1-11, + 4 plates. Cambridge, January 1915.

The improvement of sugarcane by breeding and selection is subject to great difficulties, the chief of which is that of cross-pollination. Owing to the structure of the inflorescence and the fact that the male and female flowers mature at the same time, it is almost impossible to devise means for controlling the pollination with success. Conditions must be made favourable to natural cross-pollination and a careful analysis of the offspring made so as to distinguish between the hybrids and recognise their parentage. This involves a previous study of the botanical characters of the sugarcane and the determination of their range of variability. This work is being done for the Indian varieties and will be published in due course.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

381 – **Experiments on Coffee Growing in Eritrea.** — BALDRATI, ISAIA, in *L'Agricoltura Coloniale*, Year VIII, No. 11, pp. 697-735 + 14 figs. + 1 diagr. Florence, November 1914.

Some attempts had been made to introduce coffee into Eritrea before these experiments (started in 1903), but none of them had been followed by commercial planting. The writer established an experimental plantation at Filfil at an altitude of 2300 to 3000 ft.; other nurseries were established under his direction at altitudes of 2550, 3200 and 4400 ft. The conditions prevailing at Filfil reach the extreme limits suitable for coffee, and its cultivation on a commercial scale is only possible with the aid of irrigation and suitable care.

The one-year-old plants, when planted out according to regulations, suffer a mortality of 50 per cent in a bad season and 15 per cent in a good season when not irrigated or shaded. When planted in a soil suitably rich in humus and protected by shade their losses do not exceed 1 per cent. All the losses occur in October. Irrigation may be dispensed with in deep moist allluvial soils.

With regard to the controversial question of the necessary amount of shade for coffee, the writer points out that no single solution is applicable to all cases, since coffee plants growing naturally in woods are different from a cultural point of view from seedlings grown in a nursery in diffuse

light. The nursery-grown plants are certainly able to resist natural conditions of temperature which would be fatal for the others.

All the experiments carried out in Eritrea were made with coffee of the *arabica* (moka) type, the beans of which are very small. This species requires a relatively dry climate and elevated ground, whilst the larger-grained *liberica* requires a damp climate and lower altitudes. During the brief series of years that meteorological observations have been made at Filfil, the average annual rainfall was 938.7 mm. (36.95 in.) on 93 days, and the mean annual relative humidity 55.5 per cent, with a maximum of 83.3 per cent in February. With regard to rainfall and humidity an altitude of 2300 to 2600 ft. is therefore the extreme limit for coffee, as it can only be grown with irrigation during part of the year, whilst dry cultivation can be considered profitable between 3300 and 5250 ft.

Manuring is recommended on soils with a poor hard subsoil ; clearing should be accompanied by deep ploughing throughout; planting out is done from January to mid-February, and also in December if water is available; the plants should be at least a year old ; they should be watered and provided with supports and dead shade at least during the first year. Heavy shade trees are not recommended, but rather wind-breaks consisting of double or triple rows of *Eucalyptus corinocalyx, Grevillea robusta, Casuarina equisetifolia* or *Melia japonica*. Cover crops are also recommended, especially *Indigofera arrecta* (wild in the district), pigeon-pea (*Cajanus indicus*), cowpea (*Vigna catjang*), *Vigna sinensis* and *Crotalaria striata*. In agreement with VAN DER LAAT, the writer recommends that the cover crop be merely cut and allowed to decompose round the base of the tree in preference to ploughing in. He also recommends planting after every fourth or fifth row of coffee one or two rows of taller plants with dense foliage to serve as a protection from low winds. For this purpose the following plants may be used : bitter orange (wild in the district), lemon grafted on bitter orange, *Cassia fistula* or *Bixa orellana*, the yield of all of which is ample compensation for the land wich they occupy.

The normal yield at Filfil is over 1 ½ lb. of coffee for a 5-year-old tree.

382 **The Composition of the Coffee Berry and its Relation to the Manuring of a Coffee Estate.** — ANSTEAD, R. D. (Planting Expert, Agricultural Department, Madras) in *The Annals of Applied Biology*, Vol. I, Nos. 3 and 4, pp. 299-302. Cambridge, January 1915.

Experiments during the past five years have shown that under a well established mixed shade of a coffee plantation some 4 tons air-dry weight of mulch is accumulated per acre per annum, and that this mulch contains 108 lbs. of nitrogen, 223 lbs. of calcium oxide, 36 lbs. of phosphoric acid and 118 lbs. of potash per acre. It seems probable that where heavy mulching is practised, as on many coffee estates, the trees receive an unbalanced ratio of plant food resulting in an excessive growth of leaf at the expense of the fruit.

Analyses of the berries in different stages of development show preponderance of potash, which remains constant throughout, whilst the proportion of phosphoric acid attains a maximum in the 4th month (Octo-

ber), then steadily declines. Experiments are now in progress to ascertain the precise mineral requirements of this crop and the most suitable stage in which to supply them.

Determination of the water content of the berries shows a steady decrease from July (87.13 per cent) to December (65.77 per cent), but during the final ripening stage in January there is a rise of nearly 1 per cent. This rise in the moisture content would appear to indicate a critical stage in the history of the berry. It may account for the premature falling and failure to ripen of the crop on certain soils and in years of low rainfall. At any rate it suggests changes in the methods of cultivation and manuring so as to develop the root area and conserve the soil moisture.

383 – **Studies on Chicory.** — GRAFE, V. (Contribution from the Institute of Vienna, Second Series, No. 72), in *Biochemische Zeitschrift*, Vol. 68, Part 1-2, pp. 1-22 + 1 fig. Berlin, 1915.

Among the plants in which starch is replaced by inulin, chicory is the only one whose leaves and roots have for long been used as human food. Its food value is chiefly due to inulin, and its use as a drug to the bitter principle that it contains, which is a decomposition product of inulin. From a study of roots produced in soils of different nature, it appears that the amount of inulin contained in the roots depends to a great extent upon the moisture of the soil, for a high degree of moisture reduces it, and drought, up to a certain degree, inreases it, in harmony with the general physiological fact that dry conditions favour condensation processes, whilst moisture favours hydrolysis. Whilst the ash content averages between 5 and 6 per cent of the dry matter, the crude fibre seems to diminish in sandy or loamy soils and to increase in humous or peaty ones, which is of a certain practical importance owing to the fact that some of the physiologically active bodies are produced by the roasting of the crude fibre. In sandy or loamy soils there is an increase of inulin and on the average also of the bitter principle, while in humous or peaty soils the reverse is the case. It is, however, possible that this is not due directly to the soil but to the influence of the general conditions of growth, climate and weather.

The attempts to isolate the natural bitter principle (that is, not decomposed by roasting) did not succeed in obtaining a chemically pure product, chiefly because it is a substance which decomposes very readily. They proved, however, that this principle is not, as had been believed, an alkaloid or a tannin, but a glucoside, the constituent sugar of which is levulose, while the non-sugar component is a derivative of protocatechu, probably the aldehyde. Both these substances are derived from inulin ; the first as a product of hydrolysis, the other as a product of dextrine decomposition, the appearance of which can be seen in the leaves under the microscope.

According to several writers, during the roasting of chicory, an increase of reducing sugar takes place at the expense of the inulin ; this, however, is not very exact, as products similar to dextrin are formed instead and also products of the decomposition of inulin similar to assamar.

The empyreumatic oil which is formed during the roasting of chicory is analogous to the caffeol resulting from the roasting of coffee, but of essentially

different composition; hence the writer proposes the name of *chicoreol*. Its chief constituent is acetic acid (63.5 per cent); it also contains valerianic acid (5.4 per cent) and acrolein (2.5 per cent), the remainder being furfurol and furfur alcohol (the toxic constituents which form upwards of 50 per cent of caffeol, and which are derived essentially from the crude fibre). Chicoreol forms on the average, 0.08 to 0.1 per cent of the roasted and powdered roots.

Comparative examination of seedlings and of the roots grown on the same soil shows that a certain parallelism exists between the absorption of mineral matter and the formation of organic constituents, for even in such cases, the formation of inulin and of the bittter principle diminishes in the more porous and moister soil, while the formation of crude fibre increases. In dry soils the reverse takes place. Further, in moist and porous soils the absorption of the alkaline earths is greatly diminished, whilst the relative proportion of alkalis in the ash remains fairly constant. It is possible that lime and magnesia have an influence on the processes of condensation which take place in the plant.

384 – **Growing Rhubarb in the Tropics.** — NEWMAN, J., in *Queensland Agricultural Journal*, Vol. II, Part. 6, p. 390. Brisbane, December 1914. MARKET GARDENING

Rhubarb has been grown in Central Queensland as easily as in the more temperate districts by treating it as an annual. The seeds are sown in boxes in February (late summer) and protected from excessive heat and moisture. They may also be sown in the open ground a month later on beds richly prepared and raised 6 inches from the surrounding land. The young plants require shelter from the sun and excessive rain, and are transplanted to permanent beds when about 6 in. high and placed about 18 inches apart each way. They must not be dibbled, but planted with a trowel, so as not to injure the forked taproot. Four months after sowing, the stalks should be ready to pull, but the number of stalks per plant should not be reduced to less than three. In Queensland the season is from May to November. Selected stalks are allowed to flower and the seed obtained is equal to that from temperate climates.

385 – **Self-Sterility in Fruit Trees** (1). — *The Gardeners' Chronicle*, Vol. LVII, No. 1463, p. 20. London, January 9, 1915. FRUIT GROWING

Before drawing conclusions from experiments on self-sterility it is necessary to consider in detail the conditions of the experiment. The enclosing of flowers by bags is not sufficient in itself to ensure self-pollination. Further, unless great care is taken in closing the mouth of the bag, small insects are liable to enter and modify the results. It is also possible that confinement in a bag may have an influence on the development of the pollen and pistil. It is certain that the experience of fruit growers can furnish very conflicting evidence as to the value of cross-pollination.

Recent experiments on this subject do not appear to have taken into account the effect of local conditions on self-sterility, and until this matter

(1) See also *B.* Feb. 1914, No. 133. (*Ed.*)

has received full investigation it is at least premature to condemn the practice of planting large numbers of one variety which is adopted by fruit growers on definite economic grounds.

386 – **Studies of the Flower and Fruit of the Peach.** -- I. CAMPBELL, C., in *Rendiconti della Reale Accademia dei Lincei*, Vol. XXIV, art I, pp. 68-73. Rome, January 3, 1915. -- II. MANARESI, ANGELO, and DRAGHETTI, ALFONSO, in *Bulletino ufficiale dell'Associazione orticola professionale italiana*, Year III, No. 1, pp. 8-12. San Remo, January 1915.

I. — The writer draws the attention of botanists to certain floral characteristics of the peach, which appear to be of the greatest interest from a biological and systematic point of view. Two forms of the peach may be distinguished as *longipetala* and *brevipetala*, according to the length of the petals. In the first type the petals are well developed and conspicuous, as in the almond, and their length exceeds that of the stamens ; in the second they hardly ever exceed half the length of the stamens. Corresponding to this difference is the division into clingstone and freestone peaches and also, biologically, the difference in the conditions of pollination and in the results of reproduction by seed of the two types. Between these two forms, the writer recognises the existence of an intermediate type with similar structure to that of the *brevipetala* type, but with developed petals and clingstone.

II. — In practice it is found that fruits unaccompanied by a shoot bud ripen earlier, but grow less than the others ; and other conditions being the same, they are sacrificed by growers when it is necessary to thin out the fruit. The writers have endeavoured to test the value of this practice by studies of peaches of moderate productiveness. The results of a long series of observations justify the following conclusions :

1. Fruits accompanied by an axillary bud are heavier than others; the differences range between 3 and 6 grams, but in the case of vigorous trees they reach 20 or even 40 grams.

2. The presence of a bud slightly retards the ripening of the fruit.

3. Peaches accompanied by buds have a less density, the majority floating in water, whilst fruits without buds always sink; in composition they have a greater acidity and a greater amount of dry matter in the pulp, whilst the proportion of mineral matter remains constant.

387 – **New Hybrid Vines obtained at the Royal Hungarian Ampelological Institute, Budapest.** — DE ISTVÁNFFI, GY., in *Ampelologiai Intézet Evkönyve*, Year V, pp. 87-98. Budapest, 1914.

Considering the difficulties due to the soil which interfere with the reconstitution of Hungarian vineyards, the writer considers that the first problem to be solved is the production of suitable hybrid stocks. After the first experiments with Hungarian and European vines, from which numerous hybrids were obtained, the work was continued with American vines, and the principal stocks, especially those of Coudere, were crossed with Hungarian vines.

With certain interruptions, about 140 numbered hybrids of various types have been obtained, of which those for stocks are still in the nursery.

Switzerland	68 283. Straw press.
United States	1 122 612 — 1 125 362 — 1 125 381 — 1 125 451 — 1 125 938 — 1 126 073 — 1 126 446. Baling presses.
	1 123 514. Potato separator.
	1 124 453. Grain shock elevator.
	1 124 539. Pneumatic stacker.
	1 125 070 — 1 125 249 — 1 125 439. Silos.
	1 125 795. Hay stacker.
	1 126 298. Hay press.
	1 126 435. Hay carrier.

Dairying machines and implements.

Canada	158 691. Churn.
	158 703. Milk cooler.
	158 811. Cream separator.
Germany	280 852. Butter-pat moulder with vertical cylinder.
	281 638. Funnel-shaped milk filter.
United Kingdom	21 172. Ventilator for churn.
	22 613 — 23 230. Cow-milkers.
United States	1 122 762. Milking machine.
	1 125 776. Cream separator.

Other agricultural machines and implements.

Canada	158 639 — 158 640. Tobacco stemming machines.
	158 697. Tractor.
Cuba	2 194. Apparatus for extracting wax and honey.
Denmark	19 744. Combined gardening implement.
	19 760. Device for freeing live stock in case of fire.
France	474 101. Apparatus for cleaning and disinfecting vegetables and animals by the use of vacuum and compressed air.
Germany	280 988. Device for tapping rubber and other trees.
	281 027. Machine for removing the fat-containing fleshy pericarp from fruits.
	281 028. Implement for tying vines and the like with wire.
	281 565. Cherry-stoning machine.
Italy	145 914. Tractor with rollers and steering device.
	145 860. New system of sulphurer for sulphur and other powders.
Netherlands	488. Implement for collecting and conducting latex.
United Kingdom	20 257. Apparatus for sharpening blades of chaff-cutters.
	20 639. Spraying machine.
	20 808. Trap nest for poultry.
	21 083. Apparatus for winding tobacco.
	21 334. Sugarcane mill.
	21 977. Apparatus for grading and cleaning fruit.
	22 086. Machine for removing seeds from cacao and like fruit.
	22 461. Device for maintaining rubber, tobacco, etc., under pressure during curing.
	23 223. Nut-cracking machine.
	23 312. Covers for sterilising soil.
	23 488. Rotary drum for malting.
	23 548. Plant for ageing and maturing wines and spirits.

United States 1 122 898. Stump puller.
1 122 934. Farm tractor.
1 123 158. Gazoline traction engine.
1 124 351. Caterpillar tractor.
1 125 085 — 1 126 005 — 1 126 552. Traction engines.
1 126 600. Drive wheel for traction engines.
1 126 034. Tractor.

RURAL ECONOMICS.

426 – **What the Farm Contributes directly to the Farmer's Living.** — FUNK, W. C., (Scientific Assistant, Office of Farm Management). — *U. S. Department of Agriculture, Farmer's Bulletin* 635; 22 pp. Washington, December 24, 1914.

This bulletin contains the result of a study carried on in the summer of 1913 by the Office of Farm Management to determine the value of that part of the farmer's living which is furnished directly by the farm. The data presented concern the food products, fuel, and the use of farmhouse. Figures are also given showing the value of the food and fuel bought, the value of which becomes important when considered in relation to the quantity furnished by the farm. The facts presented here will be supplemented by a more general study of the subject.

Studies were made in ten localities, of which three were in cotton-growing sections, two in the corn belt, two in general farming sections and three in typical dairy sections.

The average annual value of food, fuel, oil, and shelter per person for the families visited was $ 129.74, of which $ 91.97 was furnished directly by the farm and $ 37.77 purchased. The average value per family was $ 595.08, of which $ 421.17 was furnished by the farm and $ 173.91 purchased. The average annual value of the use of the farmhouse was found to be $ 125 per family. The importance of this is fully appreciated by the family in the town or city paying house rent.

The house labor was performed chiefly by members of the family, only 4 per cent being hired. The average annual value of this labor was $ 203 per family.

The average cost of board for each person, that is the value of the food and its preparation, was $ 10 a month. The cost of board and lodging was $ 14.62. Of this sum, on the average only 22 per cent was paid out in actual cash by the farmer.

The result of these studies shows that the farmer's cost of living in actual cash expenditures is very materially reduced by what the farm furnishes in food products, fuel, and house rent; in fact, the income from this source adds as much to the real wealth of many farmers as does the net income from the sale of farm products.

If it were not for those products contributed by the farm without any actual cash expenditure, a great many farmers would not have a comfortable living.

Extensive investigations relative to the profits in farming indicate that the average labor income of the farmer probably differs little from ordinary farm wages, but in addition to this he has the products contributed by the farm.

Of the 483 families visited, 72 per cent were those of the owners of farms and 28 per cent were tenants. The average size of the farm owner's family was 4.7 persons and of the tenant's 4.4. The comparison of the food products used on owned and rented farms shows that the tenants buy eight dollars' worth of food less per person annually than the owners. Tenants depend largely on the farm for food. Owners have both labor and capital income and hence have more with which to buy food.

AGRICULTURAL INDUSTRIES.

427 – **The Present Condition of the Chemical Examination of Wine.** — PAUL, THEODOR, in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 28, Part. 10-12, pp. 509-548. Berlin, December 15, 1914.

The differences of opinion existing as to the question of the acidity of wines, and especially regarding the changes taking place in the proportion of acids during ripening and ageing, induced the writer to make analyses according to modern physical chemistry, in order to determine the exact contents of the acid and basic components.

After a detailed description of the methods and the apparatus required, the writer gives a summary of the condition and aims of wine analyses.

1. We are at present in a position to ascertain with sufficient exactitude most of the ingredients of wines, but are without the means of determining certain substances (extracts, or those upon which colour and bouquet depend).

2. A complete wine analysis should inform us of :

a) the nature and quantity of the practically important bodies present in the wine ;

b) the distribution of the bases (cations) and the acids (anions), *i. e.* the ion-balance ;

c) the conditions of combination of the acids, *i e.* the percentage of «free» and «combined» acids in the wine ;

d) the degree of acidity, *viz.* the concentration of the hydrogen ions.

428 — **The Use of Goosefoot Seeds in Bread-making** — HANANSEK, T. F., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 29, Part 1, pp. 17-25. Berlin, January 1915.

The microscopic recognition of seeds of goosefoot (*Chenopodium album* L. and *Chenopodium murale* L.) in flour, was the occasion of the writer making the present comunication.

Amongst the different weeds of cultivated land, the species of *Atriplex* and *Chenopodium* occur not infrequently in large numbers on the borders of fields.

In Peru and Chile, from time immemorial the quinoa (*Chenopodium quinoa* L.), a very near relative of *C. album*, which it greatly resembles, has

been cultivated for food purposes, and flour for bread-making has been obtained fron its seeds. In the region of the Mediterranean, the quinoa is grown as a forage plant. In the famine year 1891-1892, an attempt was made in Russia to use seeds of *Chenopodium* mixed with rye-flour for bread-making purposes. Considering their chemical composition, and that quinoa is a very ancient article of diet, *Chenopodium* seeds are not entirely to be rejected as a source of bread.

429 – **The Peufaillit Method for the Retting of Flax**. — DURAND, ALBERT (General Secretary of the Flax Growers' Society of France) in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 113, 2nd Half Year, Vol. 121, No. 2, pp. 153-186, 25 figs. Paris, 1914.

Of the numerous methods of retting flax recently invented, the following have been submitted to careful experimentation: Legrand-Vansteenkiste, J. B. Cousinne, Emile Feuillette (1), Peufaillit. The first two are semi-agricultural processes, since, though the factors temperature, duration and the nature of the fermentation are controlled, the drying is left to the weather, whereas the remaining two methods are industrial processes in the exact sense of the word. The Feuillette process has been already adopted on a large scale.

As distinct from the others, the Peufaillit process is exclusively chemical and based on the action of hydrocarbons under pressure in the presence of water vapour. The bundles of flax are ranged in metal baskets, two of which are placed in one autoclave. After exhausting the air, the autoclaves are filled with water. Heavy petrol is then injected in the proportion of 4 per cent by weight of the flax. The pressure is gradually increased to 35 lbs. per sq. in. and maintained during 8 hours. The autoclaves are emptied under pressure and the strands of fibres separate intact. The flax is then dried and beaten with rotating cylindrical beaters and the fibre is so completely separated that stripping is unnecessary. After combing the process is completed. The proportion of tow is reduced to a minimum. The fibre has a characteristic colour of its own, and is uniform and tough. The smell of petrol is perceptible in the tow, but is very slight in the fibre and disappears completely at the first combing.

A bye-product is obtained from the gummy substance remaining in the autoclaves, the sale of which should cover a considerable part of the expenses.

This method is also applicable to the extraction of other fibres, such as hemp, ramie, palm, papyrus.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

430 – **Determination of the Degree of Homogenisation of Milk**. — VON SORBE, O., in *Milchwirtschaftliches Zentralblatt*, Year 43, Part 20, pp. 503-506. Hanover, October 14, 1914.

The homogenisation of milk is the process of mechanical trituration of the fat globules so that little or no cream can be separated. Since the milk should previously be heated to a temperature of 65° C. (149° F.) this process is only applicable in dairies with apparatus for pasteurisation or sterili-

(1) See *B.* Dec. 1912, No. 1626. (*Ed.*).

sation. The object of the process is to render the milk more digestible and to give it a better flavour and appearance. It also prevents the skimming of milk by the retailer.

A patent for the homogenisation of milk was taken out in 1892 by MATHIEU JULIEN. This was improved upon by AUGUSTE GAULIN in 1902 by an apparatus consisting essentially of: 1) a 3-cylinder force pump, which, at an average pressure of 250 to 300 atmospheres, forces the milk through capillary tubes into a single jet, and 2) a movable piece of agate containing channels placed in the orifice to regulate the rate of flow and consequently the pressure. The BERBERICH-SCHROEDER homogeniser, patented in Germany in 1904, is an improvement on the preceding in that the agate is in the form of a cone with small spiral channels which give the cone a rotary motion as the milk passes through. The milk is thus thrown against the walls of the orifice with great force, causing the globules to break. With this arrangement the apparatus can be worked successfully at a pressure of 150 atmospheres. A later improvement in 1912 enables the pressure to be reduced to 125-130 atmospheres.

The degree of homogenisation of milk is determined by the percentage of fat remaining in the lowest 50 cc. of a 250 cc. sample of milk after standing 72 hours. The fat is estimated by the Gerber test, of which at least two determinations are necessary. One drop of formalin is added to each 100 cc. of homogenised milk used for analysis; 250 cc. are placed in a graduated tube and allowed to stand for 72 hours at room temperature. At the same time a sample of the un-homogenised milk is also taken and treated similarly. After 72 hours the samples are divided into three layers, the lowest layer of 50 cc., an intermediate layer of 150 cc. and the uppermost layer of 50 cc. The fat content of each of these layers is determined separately. KÖHLER'S method is the most suitable for the analysis of the lowest layer of the non-homogenised milk. The degree of homogenisation is the fat content of the lowest 50 cc. expressed as a percentage of the fat content of the original milk.

431 – **The Importance of Milk Sugar in Judging Milk.** — GABATHULER, A., in *Zeitschrift für Fleisch-und Milchhygiene*, Year 25, No. 7, pp. 97-100; No. 8, pp. 113-119; No. 9, pp. 135-140. Berlin, January 1 and 15 and February 1, 1915.

The milk sugar content of milk is liable to individual variations and depends upon the lactation period, the amount of rest enjoyed by the animal (repose being favourable to its production) and in fact upon the state of health of the mammary glands. The smallest disturbance of the activity of the glands shows itself in a decrease in the formation of milk sugar. At the beginning of the lactation period, when these glands are not yet in full activity, the amount of the latter substance is small; it then soon reaches its maximum, to sink once more towards the end of the period. Heat has little effect upon the production of milk sugar (the amount increases afterwards for a short time); castration is without any noticeable influence. According to the writer, the sugar content is highest in the middle of milking and decreases towards the end. A salty taste of milk does not depend upon an increased secretion of salt, but chiefly upon a diminished production of milk sugar.

The writer, in conclusion, recommends that in judging milk from a hygienic point of view its lactose content should be taken into account.

432 – **A Comparison of the Microscopical Method and the Plate Method of Counting Bacteria in Milk.** — BREW, J. D. — *New York Agricultural Experiment Station, Bulletin,* No. 373, 38 pp. Geneva, N. Y., February 1914.

The number of bacteria in milk was determined in 450 samples, which were examined: 1) by the usual plating method, and 2) by making microscopical preparations and counting the bacteria directly under the microscope.

Comparing the results obtained by the two methods, it was found that the microscope method almost invariably yielded higher figures than the plating method. The relative differences between the two counts, though very irregular, were generally greater where the bacteria were few in number; in samples of milk showing plate counts of less than 10 000 per cc. of milk, the count with the microscope showed approximately 44 times as many individual bacteria, while those samples which gave a plate count of about 1 000 000 per cc. of milk only showed 5 or less times as many individual bacteria under the microscope.

A large number of the bacteria counted under the microscope existed in clumps and from the results obtained it would appear that each clump only gave rise to one colony, but beyond this there was evidence that not all the bacteria seen under the microscope were able to develop on the nutrient agar medium, and that this inability to develop tended to decrease and disappear as the total number of organisms in the milk approached 1 000 000 per cc.

The microscope method of counting bacteria in milk, besides giving more accurate results when the total number of organisms is low, has the further advantage of being rapid and relatively very simple, so that in some cases it might be substituted for the plate method with advantage.

433 – **Studies in the Expansion of Milk and Cream.** — BEARCE, H. W., (Bureau of Standards, U. S. Dep. of Commerce) in *Journal of Agricultural Research,* Vol. III, No. 3, pp. 251- 268. Washington, D. C., December 1914.

An investigation on the specific gravity of milk and cream was carried out in order to determine the change in volume which occurs with variations in the temperature, so that accurate allowance can be made in measuring milk or cream by volume at high temperatures.

The specific gravity determinations were made by the method of hydrostatic weighings over a range of from 0° to 50° C. and with samples in which the fat content varied from 0.025 to 40 per cent. Having determined the density of each sample and the rate of change of density with change of temperature, 20° C. was adopted as the standard temperature and a table was drawn up giving the volume of all samples at all temperatures calculated in terms of the volume at 20° C.

The results, though sufficiently accurate for the purpose for which the investigation was undertaken, revealed certain anomalies which made it appear that the rate of expansion of any given sample depends on something

more than the density or the percentage of fat present, *viz.* on the chemical and physical condition of the sample, which are largely controlled by the time that has elapsed since the preparation of the sample, and upon the temperature at which it has been kept.

434 — **Mouldiness in Butter.** — THOM, C., and SHAW, R. H., (Bureau of Animal Industry, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. III, No. 4, pp. 301-310. Washington, D. C., January 1915.

Mould may cause deterioration in butter either by developing on the wrapper and spoiling the appearance of a sample, or by growing in the butter itself and producing thereby such changes in the composition as to make the butter unsaleable. The nature and conditions of growth of such moulds were studied; it was found that imperfectly washed butter, containing a high percentage of casein, provided the most favourable medium of growth and that a high water content also encouraged the development of mould, as did storage in very damp cellars; but practically all risks of damage from this cause were eliminated by the presence of 2.5 to 3 per cent of salt in the butter, which corresponds to the use of 12 to 15 per cent brine.

435 — **The Manufacture of Cheese from "Heated" Milk. Part 2.** — BENSON, MILES (British Dairy Institute, Reading), in *The Journal of the Board of Agriculture*, Vol. XXI, No. 10, pp. 878-889. London, January 1915.

In continuation of previous work (1), the present investigation was undertaken in order to determine the effect of maintaining milk at the pasteurising temperature for 15 or 30 minutes in the "retainer" instead of cooling it immediately; the effect of the different processes on the bacterial content was investigated at the same time.

The experimental cheeses were each made of 200 lbs. of milk and run in sets of four consisting of one control, one in which the milk was heated and cooled immediately, one heated and retained 15 minutes before cooling and one heated and retained 30 minutes; the temperature to which the milk was heated varied from 140° to 200° F. Starter was added in rather larger proportions than usual to hasten the process of cheesemaking. No special difficulty was met with in coagulation up to a temperature of 190° F. with the immediately cooled milk or of 170° F. with the "retained" milk; above these temperatures more rennet was required than for the control milk, the curd obtained was weak and the cutting had to be done gradually and with great care in order to harden the curd as much as possible and prevent excessive losses of fat.

After four months ripening the cheeses were judged by experts who awarded points as given in the adjoining table (next page).

A large number of the ripened cheeses made from heated milk were not typical Cheddars but blue-veined cheeses and of excellent flavour and quality, the change of type being attributed either to the loss of elasticity of the curd with the consequent production of a less dense cheese where the moulds could develop in the more widely distributed air spaces, or to

(1) See *B.* Sept. 1913, No. 1088. *(Ed.)*.

Date of manufacture	Treatment of milk	Temp. of pasteurisation	Marks awarded					
			Flavour Max. 35	Quality Max. 30	Texture Max. 15	Colour Max. 10	Finish Max. 10	Total Max. 100
1913		deg. F						
July 17.	No heating	—	15	20	12	10	10	67
	Heated and "retained" 15 min.	140	30	25	15	10	10	90
	» » » 30 »	»	30	25	15	10	10	90
July 18	No heating	—	10	15	10	9	10	54
	Heated and cooled immediately	150	20	25	10	8	10	73
	Heated and "retained" 15 min.	»	25	25	10	8	10	78
	» » » 30 »	»	30	25	15	10	9	89
July 21	No heating	—	8	25	10	8	7	58
	Heated and cooled immediately	160	10	25	10	8	7	60
	Heated and "retained" 15 min.	»	35	30	15	10	10	100
	» » » 30 »	»	15	25	15	10	10	75
July 22	No heating	—	10	25	10	8	5	58
	Heated and cooled immediately	170	10	25	10	9	10	64
	Heated and "retained" 15 min.	»	5	5	3	9	5	27
	» » » 30 »	»	5	5	3	9	5	27
July 24	No heating	—	20	25	15	10	9	79
	Heated and cooled immediately	180	10	25	12	10	9	66
	Heated and "retained" 15 min.	»	30	25	12	10	8	85
	» » » 30 »	»	25	20	10	10	5	70
July 25	No heating	—	10	20	10	8	9	57
	Heated and cooled immediately	190	20	25	10	8	10	73
	Heated and "retained" 15 min.	»	30	25	12	10	8	85
	» » » 30 »	»	20	20	10	8	6	64
July 28	No heating	—	15	25	12	10	9	71
	Heated and cooled immediately	200	30	25	12	10	8	85
	Heated and "retained" 15 min.	»	27	25	10	10	8	80
	» » » 30 »	»	5	5	3	9	5	27

the destruction of the organisms inhibiting the growth of moulds. So far as the experiments go, they seem to show that if a typical Cheddar cheese be required, the milk should not be previously heated above 190° F. if cooled immediately, or beyond 160° to 170° F. if the milk be "retained" for 15 or 30 minutes. Points were awarded to the "heated" milk cheeses on the basis that they were blue-veined cheeses and not Cheddars, as they were judged to possess an excellent market value; in this way the "heated" cheeses usually scored higher total marks than the untreated cheeses, showing that a better quality of cheese can in some cases be made by the use of pasteurised milk than by the use of the same milk in the raw condition.

A chemical analysis of the cheeses subjected to the four different treatments showed that the cheeses made from "heated" milk contained a higher percentage of water and consequently a slightly lower percentage of fat. The percentage of insoluble nitrogen also increased in the "heated", cheeses as did the acidity, the latter fact being possibly due to the addition of larger quantities of starter.

With regard to the bacteriological examination, it was found that when milk was heated and cooled immediately, effective reduction in the number of organisms in the milk was not obtained until the temperature was raised to 170° F.; at this point the number of organisms was reduced to one fiftieth of the total; at 180° F. the reduction in number amounted to one eighty-eighth of the total; at 190° F. and 200° F. the number was reduced almost to nothing. When the milk was retained for 15 minutes at 150° F. there was a greater reduction in the number of organisms than was obtained by immediately cooling the milk from 170° F.; when retained for 15 minutes at 170° to 200° F. the number of organisms growing upon plates was reduced to practically *nil*. When the milk was "retained" for 30 minutes instead of 15, it did not appear to produce results appreciably differing from those obtained by retention for 15 minutes. Complete sterility was not obtained at any temperature.

In conjunction with these experiments a further set was carried out to test the variations between the bacterial content of the pasteurised cooled milk in the cooler and in the vat before any starter or other substance had been added. On almost every occasion it was found that there was a definite increase in the number of organisms in the vat compared with the numbers found in the milk as it came from the cooler. These results may have been due to the fact that the milk was twice poured in being transferred to the vats, giving rise to the breaking up of bacterial clumps. It may also have been due to contamination from the air and to insufficient sterilisation of the churns and vats, though live steam was used for the latter purpose. To what extent the results were due to any one of these causes the experiments do not show. It remains clear that milk once pasteurised should be handled as little as possible before it is put to the use for which it is intended.

436 – **Composition of Roquefort Cheese Fat.** — CURRIE, J. N. (Bureau of Animal Industry, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. II, No. 6, pp. 429-434. Washington, September 1914.

The difficulty of obtaining a cheese of the Roquefort type in the United States has been attributed to differences in composition between sheep's milk and cow's milk; in a previous paper, the writer has shown that the peppery taste of the cheese is due to the accumulation during the ripening process of certain volatile fatty acids of the group insoluble or only partially soluble in water. A comparative study was therefore made of the fat of cow's milk and the fat of typical imported Roquefort cheese with special regard to this group of acids. The results show that the differences between the two kinds of fat are not great enough to warrant the exclusive use of sheep's milk in the manufacture of Roquefort cheese, but that an imported cheese made wholly or chiefly from sheep's milk will have more of the peppery taste than a cheese of the same ripeness made from cow's milk.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

437 – **Physiological Changes in Sweet Potatoes *(Ipomoea batatas)* during Storage.** — HASSELBRING, HEINRICH, and HAWKINS, L. A. (Plant Physiologists, Plant Physiological and Fermentation Investigations, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. III, No. 4, pp. 331-342. Washington, D. C., January 1915.

During the period of growth the reserve materials in the sweet-potato are deposited almost wholly as starch. Immediately after the roots are harvested there occurs a rapid transformation of starch into cane sugar and reducing sugars. This initial transformation seems to be due to internal causes and is largely independent of external conditions. Even at a temperature of 30° C. both cane sugar and reducing sugars accumulate during this initial period in excess of the quantity used in respiration, while during subsequent periods the quantity of reducing sugar diminishes at that temperature as a result of respiration.

When stored at temperatures between 17.7° and 16.7° the moisture content remains fairly constant. There is a gradual disappearance of starch during the first part of the season (October to March) and probably a reformation of starch accompanied by a disappearance of cane sugar during the latter part of the season (March to June). These changes appear to be correlated with the seasonal changes in temperature, and are more marked than the changes in reducing sugar.

In sweet potatoes stored at 4° C. there is a rapid disappearance of the starch and an accompanying increase in cane sugar. These changes, however, do not attain a state of equilibrium, as the potatoes invariably rot by the action of fungi before the changes have reached a maximum. Thus, at both high and low temperatures cane sugar is the chief product formed by the conversion of starch, and the quantity of invert sugar always remains very small.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

438 – **A Decree Concerning the New Organisation of the Service of Phytopathological Inspection Extended to Agricultural Produce in France** (1). — *Journal Officiel de la République française*, Year XLVII, No. 40, pp. 694-695. Paris, February 10, 1915.

The President of the French Republic issued the following decree under date of February 5, 1915 :

Article 1. — The Service for Phytopathological Inspection of Horticultural Products, instituted as a department of the Ministry of Agriculture by decree of May 1, 1911, and modified by that of January 16, 1913, is extended to agricultural products and is known under the title of the Service of Phytopathological Inspection (Service d'inspection phytopathologique).

Art. 2. — The staff of the Service is nominated by ministerial order within the limits of the appropriation for this purpose in the Budget of the Ministry of Agriculture. It consists of : *a*) A chief inspector, the Head of the Service, to whom is entrusted the scientific direction of the Service, the superintendence of the work of the inspectors, sub-inspectors and controllers, and the furnishing of necessary instructions to these officers to enable them to carry out all the scientific researches required by the present decree ; *b*) an assistant to the chief inspector, whose duty it is to assist the principal inspector in his work ; *c*) temporary agents with the title of inspectors entrusted with visiting those establishments for the export of "nursery produce" or "agricultural produce of plant origin" which are committed to their care and with seeing that the crops and their products are free from all dangerous parasites, and if necessary, providing certificates of phytopathological inspection ; *d*) temporary agents bearing the title of sub-inspectors and capable of supplementing the inspectors of the Service in the branch which is especially entrusted to them ; *e*) temporary agents bearing the title of controllers and specially entrusted with the

(1) See also *B.* March 1913, No. 312. (*Ed.*).

superintendence of the consignments of "nursery produce", from the point of view of their soundness, according to the terms of the ministerial decree.

Art. 3. — The officers of the Phytopathological Inspection Service are required to ensure, within the limits of the present decree and the ministerial instructions, the supervision of those export establishments and branch institutions entrusted to them. When on inspection tours, the inspectors must be provided with the card proving their identity; this they receive from the Minister of Agriculture.

Art. 4. — The inspectors, sub-inspectors and controllers are proposed by the chief inspector and nominated annually. Their number varies according to the requirements of the Service. The conditions for recruiting these officers are settled by ministerial decree.

Art. 5. — The positions of chief inspector and assistant chief inspector are to be held by Directors of State Scientific Institutions nominated by the Minister of Agriculture, who will also apportion to each individual his special task.

Art. 6. — The chief inspectors, inspectors, sub-inspectors and controllers nominated under the present decree receive in remuneration of their services, and for their travelling expenses, a sum which is not subject to the deductions prescribed by the law of June 9, 1853, in the case of civil pensions and is calculated according to a basis fixed by decree of the Minister of Agriculture.

Art. 7. — The expenses entailed in the phytopathological inspection are stated in a special clause in the budget of the Ministry of Agriculture. They are apportioned among the persons interested in the following manner:

1) As regards the phytopathological inspection of "nursery produce": the first charge of the expense is covered by a fixed annual tax of £ 1, levied upon each controlled establishment, and the surplus is divided in proportion to the market value of the products for which phytopathological certificates have been granted.

2) As regards the phytopathological inspection of "agricultural produce of plant origin": the expenses are divided in proportion to the market value of the products for which the phytopathological certificate has been granted. The portion to be contributed by each exporter is recovered by means of taxes levied and collected by the Minister of Agriculture, even in the case of partial or total refusal of phytopathological certificates. These sums are entered under the head "Various contributions to the budget".

Art. 8. — Every exporter of "nursery produce" who wishes to submit his premises to phytopathological inspection must apply to the Minister of Agriculture before April 1 of each year, writing his request upon stamped paper according to the prescribed form and pledging himself:

1) To conform absolutely to the instructions of the Minister of Agriculture, or his representative, in all matters concerning phytopathological inspection.

2) To state in a declaration accompanying his request the precise situation of the plantations to be inspected and the approximate area of each.

3) Not to include among plants which he sends away, any from unsupervised plantations, without furnishing to the inspector in his district entrusted with supplying phytopathological certificates, the name and address of the nurserymen furnishing the said plants, whose establishmnets must also be under State control.

4) To send with each request for a certificate of pathological inspection : *a*) a certified copy of the invoice accompanying the goods which tallies with his book-keeping entries and gives the detailed and total value of the plants sent ; *b*) a declaration to the effect that the " nursery produce " included in the consignment comes from crops submitted to State control.

5) To provide the officers of the Service charged with visiting his establishments with all necessary assistance in the discharge of their duties.

6) To pay at the prescribed intervals the amount which falls to his share of the expenses incurred in the organisation of the Service of Phytopathological Inspection, in accordance with the provisions of article 69 of the laws of July 15, 1914, and of article 7 of the present decree.

Every exporter of " agricultural produce of plant origin " who wishes to submit his products to phytopathological inspection must write his request upon stamped paper according to the prescribed form, pledging himself :

1) To conform absolutely to the instructions of the Minister of Agriculture, or his representative, in all matters concerning such inspection.

2) To send with each request for a certificate a certified copy of the invoice accompanying the goods which tallies with his book-keeping entries and gives the detailed and total value of the plants sent.

3) To provide the officers of the Service charged with visiting his establishments with all necessary assistance in the discharge of their duties.

4) To pay, at the prescribed intervals, the amount which falls to his share of the expenses incurred in the organisation of the Service of Phytopathological Inspection, in accordance with the provisions of article 69 of the law of July 15, 1914, and of article 7 of the present decree.

Art. 9. — The State assumes no responsibility for itself and its agents as regards the possible results, either to the exporters or to any third party, of the organisation or working of the Service of Phytopathological Inspection provided by the present decree, or as to the acceptance or refusal by foreigners of the phytopathological certificates.

Art. 10. — As soon as the officials and agents of the Service are aware that the exporters have not fulfilled all their engagements, they must at once inform the Minister of Agriculture, who will decide upon the necessary measures to be taken.

Art. 11. — The Ministers of Agriculture and of Finance are entrusted, in their several capacities, with the execution of the present decree.

439 – **The Protection of Cultivated Plants in Algeria**. — *Communicated by* M. LOUIS-DOP *Vice-President of the International Institute of Agriculture, Delegate of Algeria, in the nam of his Government.*

Under date of February 5, 1915, M. LUTAUD, Governor-General o Algeria, sent to the Prefects of Algiers, Oran and Constantine, as well as t the General commanding the Division of Oran, the following circula regarding the decision taken by the International Phytopathologica Conference held in Rome from February 24 to March 4, 1914 (1):

" I have for some time devoted myself to improving the efficiency o the organisation of the protection of cultivated plants against the insect and cryptogams which may threaten their existence or hinder their development.

" This protection of plants in a systematic and complete organisation should include the existence of two technical Services (an entomological and a phytopathological Service) and of an executive organ (a Service of inspection, of control and of propaganda). Now a similar organisation could not be created without large available sums in the budget; further, it is not at the present time indispensable in Algeria. It therefore seemed to me sufficient to institute for the moment a more rudimentary and simple organisation, capable nevertheless of satisfying the present wants, but at the same time so constituted as to be able by means of simple extension to be adapted to the growing needs and to act as a complete organisation when necessary. With this intention, and in conjunction with the Special Commission which met last year, I decided to add to the already-existing Botanical Service, whose field of work comprehends all questions relating to plants, the necessary technical and executive agents.

" This scheme of organising a Service of plant protection is not a complete innovation of which the original conception can be claimed by Algeria; it was, in fact, inspired by the principles that had already been profitably applied in some States and which a universal tendency was seeking to generalise. France herself, justly anxious to secure the advantages accruing from such an organisation, especially when it is adopted by a large number of States, had proposed the holding under the auspices of the International Institute of Agriculture in Rome, of a Conference which concluded with a final draft Convention based on the same principle that has guided us: this draft Convention was adopted by all the large States. The contracting States undertake according to this Convention to 'adopt the legislative and administrative measures necessary to ensure common and effective action against the introduction and spread of plant enemies. These measures shall deal especially with..... the efficient supervision of nurseries, gardens, greenhouses and other establishments supplying the market with living plants...; the reporting of the appearance of plant diseases and of injurious animals and the specification of infected districts; ..... the checking and preventing of plant diseases ; ..... the regulation of the transport and packing of plants and of the parts of plants mentioned above..... ; the measures to be taken in case of the infringement of regulations '.

(1) See *B.* April 1914, No. 384. (*Ed.*).

" The same draft Convention sets forth that ' There shall be created in each State adhering to the Convention an official Phytopathological Service for the purpose of carrying out these measures. The official Phytopathological Service will include as a minimum..... the creation of one or more research stations for scientific and technical investigations,.... the organisation of the efficient supervision of crops,..... the inspection of consignments,..... the issue of phytopathological certificates '.

" Thus it is no longer a question of only realising a programme proposed by my Government and which was long maturing, discussed in the Great Commission, and adopted by the latter, but also of carrying out an international engagement entered into solemnly last year in Rome by the representatives of Algeria. Further, the great utility of the scheme would be sufficient to stimulate our desire of putting it into effect.

" With regard to the ' scientific and technical researches ', I have decided that M. MAIRE, mycological botanist, Professor in the Faculty of Sciences at Algiers, and M. DE PEYERIMHOFF, entomologist, Head of the Station of Forestry Research for North Africa, both provided with the necessary laboratories, shall lend their assisance to Dr. TRABUT, Director of the Botanical Service. These specialists will devote their attention to :

" 1) The organisation of researches into the life-history of parasites, the injury done by them, the means of prevention or control to be adopted.

" 2) The supplying to private individuals and to communities of any information of a phytopathological character that they may need.

" 3) The proposal to the Government of such measures as are calculated to protect crops.

" As regards the executive organ (inspection, control and propaganda), it appeared to me most natural that it should be constituted by the present Phylloxera Service. The latter was the more prepared for the discharge of this duty, because simultaneously with the execution of its special mission, which will be part of the work of the new organ, it has already provided for the visiting and disinfection on arrival of vines and cotton seed, as well as for the visiting of horticultural establishments that are under State control.

" The above-mentioned Commission has approved of this transformation of the Phylloxera Service, and the Algerian Financial Assembly also gave its consent at the time of the voting of the budget of the colony for the financial year 1915.

" For this reason I definitely institute this change, in view of which I recently decided, as is well known, that the Phylloxera Service shall in future lend its assistance in matters regarding the control of locusts.

" It is understood — without any change being made thereby in the task entrusted to the local Government authorities and to private individuals by the regulations in force — that the Inspectorate in question shall now be charged with superintending the application of all regulations respecting the protection of crops, and, when necessary, with providing for their execution.

" Upon the agents of this Service will therefore devolve the task of

controlling the execution of the said regulations and of applying the measures to be prescribed by the State or any other administrative body, and lastly of spreading information on control methods and instructing private individuals or societies of such persons in carrying out the duties incumbent on them and assisting them to do so if necessary.

" These same agents shall, on the other hand, keep themselves continually well informed of the sanitary condition of the crops in their district, so as to be able to give immediate notice to the Scientific Services, through me, of the presence of parasites and to place the Government in the position of being able to take the necessary measures.

" They will inspect consignments of plants and give phytopathological certificates.

" The task thus entrusted to the agents of the Inspectorate of the protection of crops, however, in no wise lessens the duty devolving upon agricultural lecturers of recording the enemies and diseases of cultivated plants, just as the work of the latter, from the point of view of plant production, is not decreased by the fact of the existence of the Central Botanical Service.

" Lastly, it is not necessary to add that individuals are not in any degree exonerated from the duty of making the declarations required by the regulations in force respecting the protection of crops.

" On account of the extension of its duties, the Phylloxera Service will now assume the title of ' Inspectorate of the Protection of Crops'. This work of inspection will be exercised under your authority by the present departmental delegate, with the same assistance from experts and the necessary staff as has hitherto been given to the Phylloxera Service.

" The departmental character of the agents of the Inspectorate will, on the other hand, not prevent their temporary employment at any point of the Colony at which their presence may be necessary.

" As heretofore, you will consult me previously as to the appointment of the technical agents whose nomination, in accordance with my decree of July 18, 1906, has devolved upon you, and these agents will be required to show that they possess the requisite special knowledge.

" I remind you on this occasion of the wish often expressed by the financial Delegations to see the expenses of the Phylloxera Service (now the ' Inspectorate of the Protection of Crops ') reduced by avoiding the nomination of any new agents who are not absolutely indispensable. This result can best be attained by entrusting the local agents of the General Agricultural Service (lecturers in agriculture, heads of experimental stations), whenever circumstances permit, with the duties hitherto incumbent upon the district phylloxera agents.

" In this manner, the Staff of the ' Inspectorate of the Protection of Crops ' will consist of as many permanent technical agents as are strictly indispensable, of experts whom it will be necessary to keep temporarily in certain parts of the country, and of the squads charged with carrying out the control operations.

" M. Stotz, regional delegate of the Phylloxera Service, who will now

assume the title of ' Inspector for the Protection of Crops' and continue to be subordinate to the Central Administration (Direction of Agriculture, Commerce and Colonisation), will undertake the superintendence of the working of the Service. In order to facilitate the work of the organs of scientific and technical research, he will render you, in accordance with the instructions that he will receive from my Government, efficacious assistance in the work to be undertaken for the control of the enemies of cultivated plants.

" I request you to notify the present instructions to the agents of your Department concerned (agents of the old Phylloxera Service and the agricultural lecturers) ".

440 - **The Importation of Young Vines into Algeria**. — *Journal Officiel de la République Française*, Year XLVII, No. 43, p. 758. Paris, February 13, 1915.

In accordance with the provisions of an order of the Governor of Algeria dated February 11, 1914, and subsequently amended by a second order of August 21, 1914, rootling vines, grafted or not, coming from France, are only allowed to be imported into Algeria if they are accompanied by a certificate given by the Inspector of the Phytopathological Service whose duty it is to issue health certificates in the district to which belongs the commune from which the vines have been sent. The certificate must state that the commune is free from black-rot (1). The date at which these provisions come into force has been fixed for March 6, 1915.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

441 - **A Contribution to the Mycological Flora of Russia** (2). — NAUMOFF, N., in *Scientific Committee of the Ministry of Agriculture, Bulletin of Applied Botany*, Year VII, No. 11 (75), pp. 728-734 (in Russian). Petrograd, 1914.

A list of 111 species collected from 1910-1914 in the Government of Petrograd, some of them being new to the district. Many of the species enumerated are parasitic on cultivated or otherwise useful plants.

442 - **The Hibernation of the Powdery-Mildew of the Vine *(Uncinula necator)*.** MOLNÁR, GY., in *Ampelologiai Intézet Evkönyve*, Year V (1914), pp. 100-101, 9 figs. Budapest, 1914.

The writer has found that in hot-houses the mycelium of *Uncinula necator* of the preceding year (still forming a grey covering to the greenish peduncles of the half-withered bunches) resumes its activity during forcing ; the contracted granular protoplasm of the hyphae becomes finely granular, entirely filling the hypha, and after some time — at no great

(1) The popular name of the disease caused by the fungus *Guignardia bidwellii* (Ellis) Viala et Ravaz. (*Ed.*).

(2) See also *B.* July 1913, No. 878. (*Ed.*).

(3) See also *B.* Feb. 1915, No. 227. (*Ed.*).

distance from the parts which still remain inactive — it gives rise to conidiophores bearing regular conidia. This proves that the mycelium can pass some time in a condition of latent life.

The writer examined the swollen, but not yet opened, buds of the vines after forcing for 4 or 5 weeks ; on the outer bud-scales there is often found a dense mycelium, on which the conidia of the previous autumn have scarcely begun to germinate. On the inner scales, there are already conidia in different stages of development, as well as more or less abundant mycelium.

The observations of the writer coincide with the facts already stated by ISTVÁNFFI, according to whom the mycelium of the oïdium, when it has once penetrated into the buds in the preceding season, has its development arrested by the cold of the winter ; but after 4 or 5 weeks, when the temperature has risen, the mycelium in the swollen buds is in full activity and fructifies, so that new conidia occur on the young leaves as soon as they unfold. Thus the first patches of oïdium, as pointed out by ISTVÁNFFI in 1904, are formed by the conidia produced in the buds.

With regard to the appearance of the perithecia of *Uncinula necator* in Hungary , the writer records four new localities : Rakovár (Szerém county), 1910, 1912, 1913 ; Kamenitza (Szérem county), 1911, 1913 ; Farkashegy (Zala county), 1911 and 1912 ; and Drava-Szabolcs (Baranya county).

Perithecia are only formed in the case of severe attacks with vigorous growth of mycelium, causing considerable injury. Under favourable conditions for the parasite, the perithecia are found from the beginning of September ; the districts mentioned above are at that season subject to thick fogs. The perithecia are not arranged on the grapes in a regular manner, but form groups, most frequently on the sides turned towards the interior of the bunch and rarely on the apex of the grape. They are formed in greatest numbers on the dampest parts. On the pedicels of the grapes, the perithecia grow by preference at the upper end ; the stalks only bear a very limited number of these organs, while the peduncle of the branch is but very rarely reached.

Perithecia are not frequent on the green shoots, and, according to the observations of the writer, they grow in the largest numbers on the lower surface of the leaves, where they form a dense layer, the petioles being free, except at their extremities. As tomentose leaves always bear a larger number of perithecia than glabrous ones, it is easily seen how favourable damp is to the production of these organs. They occur more rarely on the upper surface of the leaves.

The perithecia begin as little amber-coloured clusters of hyphae ; as a rule, four pairs of hyphae contribute to the formation of these clusters by the intertwining of their branches. The ripe perithecia generally measure 115 μ and usually contain 3 or 4 asci (each with 6 or 7 spores). As the number of perithecia on a normal leaf my be estimated at 60 000, they can produce about 1 ½ million ascospores. One can thus easily imagine the enormous quantity of reproductive organs — even allowing for only 300 leaves per vine after summer pruning.

The writer recommends the collection, after the vintage, of all the leaves and dry branches, which should be burnt as soon as possible, instead of being buried in the soil by the earthing-up.

443 - ***Gloeosporium caulivorum*** **injuring Red Clover in Hungary** (1). — HEGYI, DEZSÖ (Chief of the Royal Station of Plant Physiology and Pathology), in *Mezögazdasági Szemle*, Year XXXIII, No. 2, pp. 55-58. Budapest, February 1915.

During the summer of 1914, it was observed that great injury had been done to fields of red clover (*Trifolium pratense*) in different districts of Hungary, but especially in those situated on the right bank of the Danube. It was stated that the fields sown in 1913 wore their usual aspect in the spring of 1914, but that during flowering, the plants turned black and withered. On examining the infected individuals, conidia of *Gloeosporium caulivorum* Kirchn. were found upon their stalks.

At the present time, this disease is very serious, though hitherto only sporadic cases had occurred in Hungary and little injury had been done. The writer is of opinion that the fungus is propagated with the clover seed, and that in order to destroy the parasite, the seeds should be soaked, before sowing, in a 1 per cent solution of copper sulphate.

444 - ***Marssonia panattoniana*** **causing Rotting of Cabbage Lettuces in Hungary** (2). — HEGYI, D., in *Kertészet*, Year I, No. 7, pp. 97-99. Budapest, 1914.

The writer records a disease of cabbage lettuce (*Lactuca sativa* var. *capitata*) due to *Marssonia panattoniana* Berl. This parasite attacks the outer leaves, producing elliptical patches (4-5 mm. by 2 mm.) on the principal veins, or circular ones on the lamina of the leaf, the mesophyll being destroyed as far as the epidermis. When the patches attain a certain size rot sets up and in a short time the whole leaf is destroyed. The disease has shown itself in Moson county at Nezsider, on forced lettuces.

Control. — The wood of the frames is disinfected with lime wash, sulphate of copper, formaldehyde, etc., and before replanting, the soil should be replaced by mould which has not been used before. Further, the diseased plants should at once be removed and burnt. As a preventive measure, the lettuces should be sprayed with 1 per cent Bordeaux mixture.

445 - **The « Ink Disease » in Young Chestnut Trees in Plantations and Nurseries** (3). BRIOSI, GIOVANNI, and FARNETI, RODOLFO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, First Half-year, Part 2, pp. 98-105. Rome, 1915.

The writers base their statements regarding the "ink disease" of chestnuts on observations made in 1913 in some chestnut plantations of the valley of the Serchio (Province of Lucca) and in the forest nursery garden of Gozzano (Province of Novara); in the latter case some of the chestnuts sown were from infected woods in the Commune of Armeno (Novara). It appears that this disease attacks not only adult trees, but also very

(1) See *B.* May 1911, No. 1540. (*Ed.*).
(2) See also *B.* May 1912, No. 861. (*Ed.*).
(3) See also *B.* Aug.-Sept.-Oct. 1911, No. 3002. (*Ed.*).

young plants and even the germinating seeds in the plantations, and that widespread epidemics of the "ink disease" may occur in the nurseries, a fact not previously recorded.

The symptoms and manifestations which precede the death of the young plants are identical with those observed in the case of forest trees which perish from this disease.

Nurseries must be very carefully watched and the young plants thence obtained should not be distributed unless it is certain that they are perfectly healthy, *i. e.* without spots or cankers on the stem (either on the portion above the cotyledons or on the hypocotyl) or roots; such spots and cankers, on account of their small size, easily escape superficial observation.

Observations on young chestnut trees in the plantations and on seedlings in the nursery show that the disease does not start in the roots and does not run a centripetal course; it is due to cryptogamic infection, which starts in the aerial portions of the plant (branches and stem) and subsequently descends to the roots. Sometimes the hypocotyl itself is directly attacked and even the upper part of the radicle of the germinating seed.

It does not appear that the disease is to be attributed to soil fatigue, or to the action of a special micromycete (*Mycelophagus castaneae* Mangin) which attacks and destroys the mycorhiza. Neither is it due to the mycelium of the mycorhiza having become parasitic through want of humus in the soil, as has been suggested by DELACROIX, nor even to the existence of mysterious toxic and ill-defined substances excreted and left in the soil by infected plants that have died.

The writers conclude that the mycological question is not of supreme importance from the points of view of the pathogenesis, prevention or treatment of the disease. It will only be entirely elucidated and solved when the researches concerning this subject are concluded and when the mycological problem has been studied from every side. In any case, the writers maintain that, even if in the future it be proved that not a single, but many, micromycetes combine to cause the complex of alterations to which is given the name of the "ink disease", this would in no wise affect their first and repeated statements which the present observations have only again confirmed.

446 – ***Hymenochaete rubiginosa* causing Rot of Chestnut and Oak Wood, in the State of New York.** — BROWN, H. P., in *Mycologia*, Vol. VII, No. 1, pp. 1-20, plates CXLIX-CLI. Lancaster, Pa., January 1915.

Hymenochaete rubiginosa (Schrad.) Lév. generally lives as a saprophyte on barked chestnuts, in the neighbourhood of Ithaca, New York; more rarely it has been found on barked oaks. This fungus, which is essentially xerophytic, gives rise to annual fruit-bodies emitting spores intermittently, when it is damp, for several months.

The presence of *H. rubiginosa* causes the rotting of chestnut and oak wood. The first evidence of incipient decay is the appearance in the wood of irregular areas of a grayish -white colour. The wood between the infected areas remains sound and like normal wood. The chemical action of *H. ru-*

biginosa commences by the delignification of the parts attacked ; as soon as the middle lamella is delignified the cells separate, or remain slightly attached by the corners ; the digestion of the cellulose continues after the elements have been separated.

The decay due to the presence of *H. rubiginosa* is comparable to that produced by *Trametes abietis* Karst. in different conifers ; it is singularly like the effect produced by *Stereum frustolosum* (Pers.) Fr. as regards superficial aspect and method of attack.

The typical rot due to *H. rubiginosa* is usually accompanied by another form of decay which is superficial and occurs at the periphery ; the elements of the wood are attacked but not entirely digested. The walls remaining are dark in colour and do not give the reaction of cellulose.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

447 – **Agricultural Pests of the Southern Provinces, Nigeria** (1). — LAMBORN, W. A., in *Bulletin of Entomological Research*, Vol. V, Part 3, pp. 197-214, figs. 1-4, plates XVII-XXV. London, December 1914.

The following notes embody the results of observations made from May 1913 to May 1914 at the head-quarters of the Agricultural Department at Ibadan, S. Nigeria, and concern only real pests of the crops growing locally.

Cotton Pests. — The larvae of a lamellicorn, recorded for the first time by JEMMETT in 1910, attack the roots, causing a considerable loss of plants. The symptoms of the attack are a gradual withering of the leaves, which ultimately turn red and fall, a slow drying of the stem, premature opening of the bolls and ultimate death of the plant. The roots then appear to be decorticated. An application of an aqueous solution of carbon disulphide (1 in 200) by means of a Gastine apparatus was successful in checking the pest.

Two species of scale-insects, *Hemichionaspis minor* Maskell and *Pulvinaria jacksoni* Newst., were found on cotton stems. The former was very abundant on some of the plants and was found also on *Urena lobata*, *Hibiscus esculentus* and various other Malvaceae, and on a species of *Ipomoea*. As the season advanced it was much checked by both larvae and adults of a Coccinellid beetle, *Chilocorus schiödtei* Muls. *Pulvinaria* was much less abundant and only found occasionally on a plot of Griffin cotton.

The larvae of a green Buprestid beetle, *Pseudagrilus sophorae*, also caused considerable damage by boring the stems. The only method of checking this pest appeared to be the destruction of the affected plants. Another stem-borer found late in the season was a Lepidopterous larva, possibly an Aegeriid.

(1) See also *B.* April 1914, No. 391. (*Ed.*).

The leaves of seedlings were frequently attacked by a leaf-miner, *Acrocercops bifasciata* Wlsm.; sometimes even the cotyledons were destroyed; the pest is readily destroyed by pinching affected leaves, but when badly attacked the plants should be destroyed.

The cotton aphis (*Aphis gossypii* Glov.) produces a characteristic wrinkling and infolding of the margins of the young leaves, but is held in check by its natural enemies: the larvae and adults of *Chilomenes lunata* F., *C. vicina* Muls., and *Hyperaspis pumila* Muls.; the larvae of *Syrphus nasutus* Wied., *Paragus borbonicus* Mcq., *P. longiventris* Bezzi, and *Micromus timidus* Hagen.

The worst leaf pest is the short-horned grasshopper (*Zonocerus variegatus* L.), which entirely defoliated numerous plants. Although cotton appears to be its favourite host, other plants were attacked, including maize, young rubber, cassava, bananas, and a variety of ornamental plants, especially *Acalypha*. Chromate of lead, prepared as recommended by LEFROY, was most effective in causing migration of the swarms.

The leaf-roller (*Sylepta derogata* F.) occurred abundantly on certain imported varieties, especially American Upland, but was less frequent on the native varieties Ishan and Meko; it is attacked by Tachinid parasites, an Ichneumon (*Xanthopimpla punctata*) and some Braconidae, but not sufficiently to keep it in check; hand-picking by small native boys was found useful.

The larvae of the Limacod moth, *Parasa infuscata* Wichg., were not uncommon but were prevented from doing serious damage by *Eumenes maxillosa* De Geer. Various beetles, including *Lagria villosa* F. and *Syagrus calcaratus* F., were found to cause a certain amount of leaf damage.

The cotton bolls were attacked by the red boll-worm (*Diparopsis castanea* Hmp.) and by *Earias biplaga* Walk., which were also found in the flower buds. The latter was attacked by a species of Eumenid wasp, *Rhynchium ventrale* Sauss. Other boll-worms were *Pyroderces simplex* Wlsm. and *Mometa zeniodes* Drnt. (1) on bolls remaining from the previous season and confining their attacks to opened bolls. Both are attacked by a parasite, *Chalcis olethrius* Waterston. The only method of controlling these pests is by collecting and destroying the damaged bolls; at the end of the season the soil should be turned over to expose the *Earias* pupae.

Dysdercus superstitiosus F. was found in considerable numbers and also *D. nigrofasciatus* Stål, *D. melamoderes* Karsch, and *Oxycarenus dudgeoni* Dist. in small numbers. These cotton-stainers were successfully captured in the wingless condition by means of small nets or by shaking them into wide-mouthed tins containing water and kerosene. Hand-picking was found to be the most effective method.

Mixed cultivation also prevents the spread of insect pests, but other Malvaceae (especially *Urena* and *Hibiscus*) should not be planted in the vicinity unless to collect pests on them.

Cacao Pests. — The only stem-borer was *Eulophonotus myrmeleon*

(1) See also *B.* March 1915, No. 335. (*Ed.*).

Feld., which attacked medium-sized branches. The pest is controlled by cutting and burning the affected branches, or, if found before much damage is done, a flexible wire may be pushed up the tunnels and the hole subsequently plugged and tarred. Larvae tunnelling in the main stem may be destroyed by injections of carbon disulphide and plugging the holes with clay and tar.

Other damage was observed, probably due to a Lepidopterous larva, and also by *Sahlbergella theobroma* Dist. and by small Bostrychid beetles.

Young shoots were found to be attacked by *Udamostigma tessmanni* Aulm. (which was effectively treated with kerosene emulsion), and by black aphids which produce a characteristic infolding of the margins of the leaf and are parasitised by Syrphid and lace-wing flies.

Leaf damage was also caused by *Zonocerus variegatus*, *Adoretus hirtellus* Castn., *Trochalus carinatus* Schönh., *Metisa sierricola* White, *Diacrisia maculosa* Cram., *Earias citrina* Saalm. These insects, of which *Adoretus* and *Diacrisia* are the most injurious, were successfully checked during the wet season by dusting with a mixture of Paris green and lime. Later chromate of lead solution was found more suitable.

The pods are attacked by a small Lymantriid caterpillar, by an Anthribid beetle, *Araecerus fasciculatus* de G., by a Lepidopterous borer, *Characoma stictigrapta* Hmp., by the scale-insect *Stictococcus dimorphus* Newst., and by a Trypetid fly, *Ceratitis nigra* Grah.

Another pest of cacao is a *Dactylopius* (*D. longispinus* Targ. or *D. virgatus* var. *madagascariensis* Newst?) found on the young shoots, flowerstalks and young pods, and attacked by the larvae of *Spalgis lemolea* H. H. Druce. It was also successfully treated by brushing with kerosene emulsion.

The following were also recorded : *Stictococcus sjöstedti* Newst., with its natural enemies *Eublemma ochrochroa* Hmp., *Totrix callopista* Durrant, and Chalcids. — *S. dimorphus* Newst. on new shoots, checked by *Eublemma scitula* Ramb. — *Icerya* sp.

White ants are also abundant on dead wood and are easily checked by means of injections of arsenical and sulphur vapours with mixture of carbon dioxide and monoxide pumped into the colonies with a "Universal Ant Destroyer".

Insects attacking Kola. — *Pundaluoya simplicia* Dist. (1) was found quite commonly in all stages on the tips of the young shoots and was destroyed by brushing with a weak kerosene emulsion. Young nursery plants were much attacked by *Adoretus hirtellus* and by *Zonocerus variegatus* L. The nuts, both on the tree and in store, were attacked by weevils, *Paremydica insperata* Fst. and *Balanogastris kolae* Desbr., which in turn were parasitised by an Ichneumonid.

Insects attacking Coffee. — Various scale-insects, *Stictococcus* in particular, were found on young shoots. The leaf-eater *Metadrepana glauca* Hmp. was also found.

Insects attacking Maize. — The stems and ears were attacked by the

(1) See below, No. 453. (*Ed.*).

larvae of *Sesamia calamistis* Hampson and *Eldana saccharina* Walk., both of which are parasitised by Tachinids and also by the larvae of *Busseola fusca* Hampson and *Mussidia nigrivenella* Rag., etc. These pests are controlled by harvesting the crop early and by clean farming.

The leaves are attacked by the larvae of *Prodenia litura* F., *Cirphis loreyi* Dup., *Plusia* sp., *Elaunon erythrocephalus* Oliv., etc.

Stored maize is badly damaged by *Calandra oryzae* L., *Tribolium confusum*, *Tenebrioides mauritanicus* L., *Mussidia nigrivenella* Rag., *Ephestia cautella* Walk. From the larvae of *Calandra* a large number of individuals of the natural parasite *Meraporus* were obtained ; unfortunately they never succeed in keeping the weevil in check. Fumigation with carbon doixide gave good results.

Insects attacking Hevea brasiliensis. — The roots of young plants are attacked by *Brachytrypes membranaceus* Drury, which in turn is parasitised by *Chlorion xanthocerus* Illig. var. *instabilis* Sm. The leaves of plants in the nursery are damaged by *Zonocerus variegatus*.

Funtumia elastica. — The larvae of *Nephele* sp. (parasitised by Braconids) and of *Glyphodes ocellata* Hmp. attack the leaves. The fruits are attacked by the larvae of *Entephria sexpunctalis* Hmp., *Berginus tamaricis* Woll., and *Arocatus continctus* Dist. (1).

Ground Nuts. — *Metisa sierricola* White feeds on the leaves, and the scale-insect *Ceronema africana* Macfie occurred on some plants.

Beans. — The stem is attacked by *Ootheca mutabilis* Sahlb., and the leaves by *Lagria villosa* F. and *L. viridipennis* F., which cause irregular holes. Both pests are controlled by collecting in light sweep-nets. Stored beans were damaged by *Bruchus* sp.

Pigeon Peas. — The stems were attacked by *Ptyelus grossus* F., and the seeds by the larvae of *Marasmarcha atomosa* Wlsm. and *Lampides boetica* L. Other pests are *Ceronema africana*, *Pseudococcus* (as on cacao), *Stictococcus dimorphus*, *Icerya* sp.

Oil Palm. — The grain weevil (*Calandra oryzae*) was found boring the stem.

Sweet Potato. — The larvae of the convolvulus hawk-moth (*Herse convolvuli* L.) (2) were found feeding on the leaves. Stored tubers were seriously attacked by *Cylas brunneus* F. and *C. puncticollis* Boh.

448 – **The Scale Insects of Ceylon.** — RUTHERFORD, A., in *Bulletin of Entomological Research*, Vol. V, Part 3, pp. 259-268. London, December 1914.

A description of thirteen species of scale insects collected in Ceylon, twelve of which are new to science.

1. *Aulacaspis flacourtiae* occurs along with *Howardia biclavis* Comst. on the twigs and branches of *Flacourtia ramontchii*, and is doubtless the insect refered to by Green as "typical" *Diaspis pentagona* (*Memoirs Dept. of Agr. in India*, I, No. 5, p. 346). The female is indistinguishable from that of *Aulacaspis* (*Diaspis*) *pentagona*. It is preyed upon by a small

(1) See below, No. 453. (*Ed.*).

(2) See *B.* Oct. 1914, No. 973. (*Ed.*).

light brown *Coccinellid* with a *Pseudococcus*-like larva and to a less extent by *Chilochorus circumdatus*, and is also parasitised by a small black Chalcid.

2. *A. myristicae*, on the mid-rib of a leaf of wild nutmeg (*Myristica laurifolia*).

3. *Pseudaonidia oreodoxae*, on the stem of the Cabbage Palm (*Oreodoxa oleracea*); also on the Royal Palm (*Acalypha* sp.) and on *Broussonetia papyrifera* Vent.

4. *P. irrepta*, on the branches of an undetermined plant (possibly *Acalypha* sp.). It is attacked by Hymenopterous parasites.

5. *Aonidiella pothi*, on *Pothos scandens* and *Loranthus* sp.

6. *Hemichionaspis alatae* on the branches of *Cassia alata*; it is near *H. minor* Mask., and may be only a variety of it. It is attacked by Hymenopterous parasites and is preyed upon by Coccinellid larvae.

7. *Chionaspis malloti*, on twigs of *Mallotus philippinensis*, causing slight swellings.

8. *Lepidosaphes erythrinae*, on the bark of *Erythrina* sp.

9. *L. ambigua*, on the twigs of *Mesua ferrea*.

10. *Aonidia ferreae*, on the twigs of *M. ferrea*.

11. *Neolecanium cinnamomi*, on the bark of branches of *Cinnamomum* sp.

12. *Parlatoria mesuae*, on the edges of the leaves of *Mesua ferrea*.

13. *Ceronema koebeli* Gr.; some insects found on *Pithecolobium saman* were referred to this species. It is subject to the attacks of Hymenopterous parasites; the larvae of *Spalgis epius* were found feeding inside the ovisac.

449 - **Coccidae from the Northern Territory of Australia.** — GREEN, E. E., in *Bulletin of Entomological Research*, Vol. V, Part 3, pp. 231-234, figs. 1-3. London, December 1914.

Eleven species of scale insects collected in 1913-1914 at Port Darwin and neighbourhood.

1. *Aspidiotus* (*Chrysomphalus*) *fodiens* Mask., on the under surface and less abundant on the upper surface of the leaves of *Pithecolobium monilierum;* known only from Australia.

2. *A. orientalis* Newst., on the leaves of the banana and leaves and fruits of the papaya; though common in India and Ceylon, it had not previously been recorded in Australia.

3. *A.* (*Chrysomphalus*) *ficus* Ashm., abundant on the leaves of coconut, and along with *Mytilaspis citricola* Packard on *Citrus acida*.

4. *A. destructor* Sign., on leaves of coconut.

5. *Hemichionaspis minor* Mask.: *a*) on leaves of *Buchanania* sp., where it was very abundant but effectively controlled by Coccinellids and Chalcids; *b*) on the branches of the kurrajong tree (*Sterculia diversifolia?*) (1), where it was mainly represented by male puparia, the few females having been exterminated by parasites; *c*) on the native vine, *Vitis* sp., parasitised as in the preceding case. This insect is recognised as an important cotton pest in the

(1) See *B.* Feb. 1913, No. 201. (*Ed.*)

United States and specialists have been sent to find an effective natural parasite. The above instances suggest that such an enemy might be found in the Northen Territory of Australia.

6. *Chionaspis dilatata* Green, on *Pandanus odoratissimus*; not previously recorded for Australia where it appears to be parasitised by the same species as *Hemichionaspis minor*.

7. *Mytilaspis citricola* Packard, abundant on the upper side of the leaves of *Citrus acida*.

8. *M. pallida* Green, on the upper side of the leaves of *Citrus acida*, associated with *M. citricola*.

9. *Parlatoria zizyphus* Lucas, on both sides of the leaves of *C. acida*, causing considerable damage.

10. *Lecanium* (*Saissetia*) *hemisphaericum* Targ., on shrubs and weeds not yet determined.

11. *L. pseudexpansum* (new). on *Pandanus odoratissimus*: very similar to *L. expansum* in appearance.

MEANS OF PREVENTION AND CONTROL

450 – **Parasites of the Olive Fly *(Dacus oleae)* in Eritrea** (1). — SILVESTRI, F., in *Bolletino del Laboratorio di Zoologia generale e agraria della R. Scuola Superiore d'Agricoltura in Portici*, Vol. IX, pp. 186-226, figs. I-XXIV. Portici, 1914.

In June 1914, the writer was instructed by the Italian Ministry of Agriculture to proceed to Eritrea, where there are extensive woods of wild olives (*Olea chrysophylla* Lam.), for the purpose of discovering and collecting the parasites of the olive fly (*Dacus oleae* [Gmel.]), in order to introduce them into Italy at the proper season of the same year.

Contrary to what had been arranged, the writer was unable to reach the Colony before August 23. As soon as he had established a temporary laboratory for rearing parasites at Nefasit, he began his visits to the olive trees of the different localities of the district, with the help of a few workmen.

On his return to Italy, on September 20, he had more than 3000 adult living Hymenoptera parasitic on olive flies and about 300 olive fly pupae, some of them parasitised, besides a collection of insects (dry or in spirit) found on the olive tree.

A systematic description, with geographical distribution and such facts as are known of the life-history, is given for the following parasites of *Dacus oleae*:

a) Fam. *Braconidae: Opius africanus* Szépl. var. *orientalis* Silv.; *O. dacicida* Silv.; *Sigalphus daci* Szépl.; *Bracon celer* Szépl.

b) Fam. *Chalcididae: Eupelmus afer* Silv. (new); *Halticoptera daci* Silv. (new); *Eutelus modestus* Silv. (new); *Atoposoma variegatum* Masi var. *afra* Silv. (new variety); *Achrysocharis formosa* (Westw). var. *erythraea* Silv. (new variety); *Teleopterus notandus* Silv. (genus and species new); *Metriocharis viridis* Silv. (genus and species new); *M. atrocyanea* Silv. (new); *Allomphale cavasolae* Silv. (genus and species new); *Tetrastichus maculifer* Silv. (new).

(1) See also *B.* Feb. 1914, No. 190. (*Ed.*)

With the exception of *Sigalphus daci*, *Teleopterus notandus*, the two species of *Metriocharis* and *Tetrastichus maculifer*, the Hymenopterous parasites were set at liberty in different numbers by the writer on his return, near Fasano (Bari, Apulia); *Opius africanus* var. *orientalis* was also liberated at Sassari (Sardinia).

A proper estimation of the usefulness of the parasites observed in Eritrea for the control of *Dacus oleae* could only be obtained by years of careful observation, so that the observations made by the writer during his short stay must be considered as having only approximate value.

In the months of August and September 1914, olive trees (*O. chrysophylla*) with ripe fruit were very rare (a dozen occurring within a radius of 10 or 15 miles) at Nefasit, so that probably all the flies from a considerable area had collected where olive fruits were to be found; consequently these were almost all infected. The larvae of *Dacus oleae*, however, were themselves attacked in the proportion of 90 per cent by parasites. Near Dedda, on the contrary, where trees in fruit were fairly numerous, the percentage of olives attacked was low. These observations show that, at any rate under exceptional conditions, the parasitism on *Dacus oleae* may be high and at the same time that the insect is not necessarily numerous in a district in which the olive is fairly frequent; it may, of course, be checked by fungi and bacteria, as well as by insect parasites.

It should be noted that the olives of *O. chrysophylla* have a rather thin sarcocarp (from 0.3 to 0.6 mm., rarely thicker), while in cultivated Italian olives it is rarely below 1 mm. For this reason the parasites with short ovipositor such as *Atoposoma*, *Achrysocharis* and *Teleopterus* (if this does not attack the eggs, but only the small larvae), could not be acclimatised in those parts of Italy where there are only cultivated olives. In these districts the control must be carried out by the other species, or at all events by *Opius africanus* var. *orientalis*, *O. dacicida*, *Bracon celer*, *Halticoptera daci* and *Allomphale cavasolae*.

The writer considers that if these Hymenoptera became well acclimatised in Italy, they could be of great use, and if they did not succeed in rendering negligible the injuries caused by the fly, they would at least reduce them much below the present averages. In fact, among them there are two species (*Bracon* and *Allomphale*) which develop at least twice as fast as *D. oleae*, while the two species of *Opius* develop nearly twice as fast as *Dacus*. These species may also exist for some time as adult insects, so that in the absence of ripe olives, they could wait, like the adult *Dacus*, for some months until others were ripe.

It is doubtful whether the small numbers of parasites liberated will be able to overcome the difficulties of introduction into a new country, so that it would be advisable to make arrangements for further shipments, if possible with a regular temporary laboratory in Eritrea for the purpose.

Search should also be made for parasites in Abyssinia, South-East Africa and Asia.

451 – **Natural Enemies of the Scale Insect, *Chrysomphalus dictyospermi* var. *pinnulifera*, Parasitic on Citrus Trees** (1). — DE GREGORIO, ANT., in *Nuovi Annali di Agricoltura Siciliana*, Series VI, Year III, Part IV, pp. 224-230. Palermo, 1914.

The writer has undertaken in Sicily the quest of possible natural enemies of *Chrysomphalus dictyospermi* var. *pinnulifera* (Mask.) As such he mentions in the first place *Chilocurus bipustulatus* L. and an Arachnid, possibly a new species, which he names provisionally *Lycosa* (?) *rapida*. Both are useful to a certain extent in reducing the number of the scale insect, but the Arachnid is much more efficacious than the Coccinellid.

Under the name of *Aphelinus* (*Prospaphelinus*) *silvestrii* De Greg., the writer gives a detailed account of a new insect belonging to the Hymenoptera, which, according to his observations, plays a very useful part in the control of *Chrysomphalus*. The female of this third natural enemy lays its eggs in the body of the scale insect.

BIBLIOGRAPHICAL NOTE.

452 – VOGLINO P., and SAVELLI, M. — *La diffusione della* Prospaltella berlesei *How. in Piemonte nell'anno* 1914 (Spread of *Prospaltella berlesei* How. in Piedmont in 1914) (2). — Turin, Stab. tip. naz., 1915 (16mo, 8 pp.).

In accordance with a pre-arranged plan, the Staff of the Phytopathological Observatory of Turin (3) visited, from the middle of September 1914 to early in January 1915, the districts in Piedmont where *Prospaltella berlesei* How. had been introduced in March 1914, to determine whether this natural enemy of the mulberry scale (*Diaspis pentagona* Targ.) had taken a hold and at the same time to inspect the old diffusion centres of the parasite.

The observations made in the provinces of Turin, Cuneo, Alessandria and Novara showed that *Prospaltella* had generally given good results. In some places, such as Settimo Torinese, Valmanera (Asti), Motta di Costigliola, Casale, Valenza, etc., *Diaspis* has been conquered from the agricultural standpoint by the recent and earlier diffusion of *Prospaltella*. The results are most evident where *Diaspis* has not yet attained such development as to cause advanced decay of the mulberry trees. In regions which are badly infested by the scale, it is necessary in order to facilitate the work of *Prospaltella*, to reduce the number of *Diaspis* by heading back the mulberry trees every two or three years, whether or not they harbour *Prospaltella*; any branches on which the parasite occurs should be hung up in other mulberry trees. Sysmatematic and frequent pruning puts the trees into excellent condition for resisting the spread of the scale insect. In Piedmont, *Prospaltella* can resist the cold of the winter. The intensive diffusion of this parasite is the only means of obtaining immediate and satisfactory results from the agricultural point of view. When it is a question of propagating it on a large scale, the material should first be examined by experts, in order to avoid any possible failure. A very common enemy of *Diaspis* is

(1) See also *B.* March 1915, No. 332. (*Ed.*).
(2) See also *B.* March 1915, No 333. (*Ed.*).
(3) See *B.* Sept. 1914, No. 856. (*Ed.*).

the beetle *Chilocorus bipustulatus* L. ; this insect should be protected by every means ; its larva has many foes.

The writers conclude by saying that the parasitic control of the mulberry scale ought always to be directed by experts, for there are many causes which may hinder the spread of *Prospaltella* and other enemies of *Diaspis*.

453 - **Injurious African Rhynchota.** — DISTANT, W. L., in *Bulletin of Entomological Research*, Vol. V., Part 3, pp. 241-242, figs. 1-3. London, December 1914.

Arocatus continctus Dist. (fam. *Lygaeidae*), originally described from specimens received from various localities in India and Ceylon, has now been found in Southern Nigeria on seeds of *Funtumia*.

Pundaluoya simplica Dist. (fam. *Fulgoridae*, sub-fam. *Delphacinae*), first described from specimens from Ceylon, has now been found on young shoots of kola and cacao in Southern Nigeria. It has also been collected from grass in cultivated places in the islands of Mahé and Praslin (Seychelles).

Oxycarenus amygdali Dist. is a new species reported on peach leaves at Amersfoort, Transvaal. Another and somewhat allied species (*O. exitiosus* Dist.), injurious to peaches near Cape Town, was described by the writer in 1905.

454 - ***Anastrepha serpentina* (Diptera) injuring Sapodilla Fruits, and New for Brazil.** — TAVARES, J. S., in *Broteria, Serie Zoologica*, Vol. XIII, Part 1, pp. 52-54 Braga; February 1, 1915.

To the fruit-flies already known in Brazil — *Anastrepha fraterculа* Wied. (1), *Ceratitis capitata* Wied. (2) and *Lonchaea aenea* Wied. — must now be added, according to the observations of the writer, *A. serpentina* Wied.

This last species was observed by him in the act of laying its eggs in a sapodilla fruit (*Achras sapota* L. = *Sapota achras* Mill.) on March 24, 1913, in the neighbourhood of Bahia. The fruit was placed on damp earth under a belljar ; on April 20 four large white larvae were found in it, ready to fall to the ground and pupate. The adults emerged a fortnight later.

INJURIOUS VERTEBRATES.

455 - **Control of the Musquash by Means of Bacterial Diseases in Austria** (3). — See above, No. 417.

(1) See *B.* Nov. 1913, No. 1311. (*Ed.*).
(2) See *B.* Feb. 1914, No. 190; *B.* Feb. 1915, No. 236. (*Ed.*).
(3) See also *B.* Feb. 1915, No. 242. (*Ed.*).

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

Qualities desired in Wheat for British Markets and how to ascertain them

by

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The Pusa Institute in Bengal, India, has now become known as one of the most important centres of agricultural research in the world. Not many years after its first establishment its directing staff was required by the Government of India to bring together all useful information on the subject of wheat growing in India, including results of experiments on farms, as well as to make a botanical survey of the wheats of the country. This work was begun in 1906. The first publication explaining what had been and was being done in furtherance of the requisition of the Government was the Book published in 1909 which may claim to be called a " classical work " on the Wheats of India (1), edited by Mr. and Mrs. Howard, whose names are now well known to the world of scientific research. It contains a botanical survey of wheats in each Province of India and brings out the more important aspects of the investigations which have been carried out in Germany, Austria, England, Canada, Australia and the United States, besides dealing with the qualities of wheat desired by importers to the markets of Great Britain and the World.

(1) *Wheat in India, its Production, Varieties and Improvement,* by ALBERT HOWARD, M. A. (Cantab), A R. C. S. (London), F. L. S., Imperial Economic Botanist, India, and GABRIELLE L. C. HOWARD, M. A., Associate and former Fellow of Newnham College, Cambridge.

Since the publication of this book, investigations in more than one direction have been continued by the Howards in association with Mr. H. M. Leake, the Botanical Expert at the important Agricultural College of Cawnpore. Reports on these have been published in the *Memoirs of the Department of Agriculture in India* in 1910, 1913 and 1914 under the Editorship of the three scientific investigators.

A principal object of research has of course been to find improved wheat, *i. e.* wheats which suit the climates and conditions of various parts of India better than any hitherto grown. "Improvement can", write the Editors in the last "Memoir of 1914" (1) be made in two main directions — "yield" and "quality". It may be said at once that the patient experiments made under the direction of the Pusa and Cawnpore experts have succeeded in evolving more than one variety of vastly improved wheat in both directions. But it is not intended in this article to follow the investigators in their surveys and experiments as regards the yield of Indian wheats — as these are more or less of local interest. The results which are likely to be of most service to countries outside India are those which are concerned with the ascertainment of the qualities demanded by the importers of wheat to British and World markets. Before, however, dealing with this section of the investigations it seems necessary to draw attention to a leading factor common to wheat production in all parts of India. "This" state the authors of the Pusa Memoir (pp. 238-9) "is the limited growth period. Wheat can, in India, "only be grown with safety as soon as the temperature falls sufficiently "for germination to take place and for the seedlings to develop. Any at- "tempt to lengthen the growth period by early sowing leads to the partial "or entire destruction of the seedlings by heat. The duration of the growth "period is equally limited by temperature at harvest time. The Indian "wheat crop ripens under a rapidly ascending temperature often accompa- "nied by hot dry winds. Any late crops dry up rather than ripen and the "rapid advance of the hot season prevents the cultivation of the late-ma- "turing wheats". The writer of the present note had, when superintending the operations of the first experimental farm established in India, located in a wheat-growing Province, a somewhat amusing experience in proof of these facts. An English philanthropist observing how small was the average outturn of wheat per acre in India as compared with the outturn in Great Britain and grieved by what he had read of Indian famines, represented to the British authorities that he could send to India a wheat which would treble the production in that country. The Government of India was accordingly invited to apply for several tons of the seed. The case was referred to the writer, who recommended a trial, to begin with, of five pounds. The first result was a row of magnificent "stools", almost bushes in appearance, but from beginning to end never an ear, much less a grain, of wheat showed itself, the splendid plants being dried up with the earliest

(1) Influence of Environment on Milling and Baking Qualities of Wheat in India. *Memoirs of the Dept. of Agriculture in India*, Vol. VI, No. 8, by Albert & Gabrielle Howard and H. M. Leake, M. A., Economic Botanist to the Government of the United Provinces.

breath of the spring hot winds, while the benevolent philanthropist was deprived of the pleasure of saving India from famines. Recently, as now in most countries, the attention of scientists in India has been directed mainly to the selection and improvement of indigenous varieties. Many successes have been obtained at the Pusa Research Station and at the farms attached to the Agricultural College at Cawnpore, and though it is doubtful how far the varieties reared in India will behave under the conditions of different climates outside India, it may be worth while to give them a trial in regions where the growth period is similarly limited.

Thus it may be noted that in Bulletin No. 11 of the Department of Agriculture in New South Wales on Wheat Improvement in Australia (1), by Mr. F. B. Guthrie, F. I. C., it is shown that Indian wheats have been found useful for crossing; one cross with Indian F (a beardless compact early-maturing type from Pusa) matured 10 days to a fortnight earlier than the well-known Fife type with which it was crossed and gave 28 to 37 per cent increased yields.

These results recommend the trial of Pusa successes, at any rate for crossing purposes, in any countries where a short growth period is a desideratum, especially as Pusa experiments show that environment has less influence on quality than might have been anticipated.

It will have been gathered from what has been already written that Indian wheat is sown in the late autumn and harvested in the early spring. The growth period is shortest in the Central and Eastern districts and longest in the Northern and Northwestern Provinces. But nowhere does the period approach the length prevalent in more temperate climates.

To return now to the investigations set on foot by the Pusa and Cawnpore experts as to the qualities required in wheat grown for British markets, which with minor exceptions means the World markets, it may be stated that the Indian investigators have had from the commencement of and throughout their researches the invaluable assistance of Mr. A. E. HUMPHRIES, Past President of the Incorporated National Association of British and Irish Millers. The enquiries with which he was associated established the very important fact that the presence or absence of the desired qualities in wheat samples could only be satisfactorily ascertained by milling and baking tests. Proceeding to the enumeration of what are the requisite qualities, descriptions of them will be found throughout the literature already referred to, which includes several reports on the Indian samples sent to him by Mr. Humphries; but as these descriptions are too lengthy, important as they are, for full quotation in this article, it will be of advantage to give the summary of them which appeared in a "Memorandum" by Sir James Wilson, who, as administrative chief of Agricultural Departments in the Punjab, the most important wheat-exporting Province of India, had a special interest in the subject, and who had the opportunity of discussing it with various milling and practical experts,

(1) See *B.* April 1915, No. 372. (*Ed.*)

including Mr. Humphries, in Great Britain (1). He thus summarised the qualities which the British miller wants in his wheat:

He wants it

(1) *Clean*, i. e. as far as possible free from dirt.

(2) *Pure*, i. e. as free from other grains as possible.

(3) *Of good quality*, i. e. well harvested and as free as possible from immature, damaged and weeviled grains.

(4) *Uniform*, i. e. as nearly as possible of one character throughout.

(5) *Dry*, i. e. capable of absorbing a considerable quantity of water in the process of conditioning.

(6) *Free milling*, i. e. neither liable to become woolly in the process of being converted into flour nor flinty nor horny in character.

(7) *Stable*, i. e. such that the dough is easily handled in large masses by the baker.

(8) *Strong*, i. e. with a flour capeble of making big, shapely loaves.

The first four in the above list have special application to India, where most of the wheat is grown on small, indeed very small, peasants' holdings, where it is threshed out by bullocks treading on an earthen threshing floor and winnowed by hand in the wind, thus naturally getting a certain amount of dust mixed with it. Moreover the seed wheat is often mixed with other grains such as barley, gram (*Cicer arietinum*) and pulses. So that a consignment from India is seldom pure. Collected too, as it is, from numerous small fields of generally unequal quality, it is not so uniform as wheat harvested from extensive homogeneous areas. The remaining four on the list are, however, qualities and conditions which seem to deserve study in the wheats of any country from which it is desired to export wheat to British markets. These last four qualities are more expansively described in the Pusa memoir and in the report by Mr. Humphries included therein.

"*Conditioning*", writes Mr. Humphries, "is a term applied to the "adjustment of the physical condition of wheat whereby an optimum "separation of branny husk from kernel can be made in milling. Where "Indian wheats are concerned it includes an addition of water varying "widely in degree according to the nature of the variety.—Some kinds are "described as 'free milling' because the separation of such wheats in "milling into their various commercial constituent products can be effected "easily; other kinds are described by the expressive term 'woolly' "because separations in milling are effected with great technical difficulty. "The *colour* of the resulting flour depends to a considerable extent upon "the facility with which these separations in milling can be effected. The "term *strength* applied to flour means its capacity for producing large "shapely loaves. *Stability* indicates the facility with which the baker can "handle large masses of dough. *Yield* of bread, which must not be con-"founded with strength, is the measure of the quantity of bread which can

(1) Memorandum on Indian Wheat for the British market, by Sir James Wilson K. C. S. I., *read before the Incorporated National Association of British and Irish Millers*, reprinted as Bulletin No. 20 (September 1910) of the Agricultural Research Institute, Pusa.

" be produced from a given quantity of flour. *Good flavour* implies a " moistness and sweetness in the taste of bread at least one day old. As " a rule white wheats are more inclined to woolliness than red wheats, but " the former *can* behave perfectly in milling and the ideal wheat will prob- " ably be a white one".

The above remarks indicate how necessary it is that those who desire to ascertain the actual qualities of a particular wheat should submit it to milling and baking tests. This view is more fully dealt with in the following paragraph of Mr. Humphries' report, which explains that no chemical tests are equally trustworthy.

" When a new kind of wheat is offered to a buyer, he forms an opinion " as to its merits upon its appearance and he probably buys the first lot " with no better guide to its intrinsic worth than its good or bad looks. " Of course, an experienced buyer is better able to appraise the real value " of good looks than a beginner. To the latter, a fine development and " cleanliness may be all important : the former has learned to know that " a fine superior may cover many faults, and dirt, which can easily be re- " moved, may nevertheless obscure real beauty. Even so, the best judges " know quite well that their judgment in such a case may be faulty. Va- " rious methods of rapid and accurate testing have been suggested. For " instance chewing has been recommended, and in certain cases for cer- " tain points of quality that rough and ready test is valuable: but it is use- " less or worse than useless in other cases, and obviously it would not be " used in the case I have presupposed, if the wheats were coated with dirt " of unknown origin. I need not labour the point that cleanliness and " a good appearance must in any and all cases materially affect the price " which a wheat will realise in our markets. But there are other points " which in most cases will militate against a new kind of wheat at the out- " set of its commercial existence. A miller has to learn how to treat it " in conditioning and milling, so as to secure optimum results, and he has " to ascertain definitely not only how it will behave in the bakehouse when " used by itself, but how it will behave when blended with many other " wheats in various proportions. All this takes much time and trouble " and the inevitable mistakes cost money, so that a buyer is not likely " to pay a full price for the first few lots of a new kind of wheat. But " if he finds by many and various tests and by long experience that it has " great intrinsic merits and can be relied upon to vary in its qualities within " small limits only, the reputation of the wheat will grow and its relative " commercial value will increase. So it may easily happen that a new wheat " of great intrinsic worth, arriving in unattractive guise from a district " which has hitherto produced wheat of poor quality, may realize at the " outset relatively poor prices on our markets and have to overcome slowly " the well or ill-founded prejudices due to its appearance, or even to its geo- " graphical source of origin; yet in time the same wheat, even in the same " unfortunate or deplorable guise, may win its way to the real esteem of " buyers, and command relatively high prices in our markets. On the other " hand, a wheat of beautiful appearance, coming from likely quarters, may,

" in time, because it is nondescript in quality, possessing no outstanding " merit of real importance, recede in relative commercial value and leave the " beginner or outsider wondering why merchants and millers have such " apparently curious ideas as to the value of wheats.

" In recent years, a good deal of work has been done by chemists " to ascertain the ultimate cause or causes of quality in wheat, but it is " true even now to say that they are unable to state with precision, in terms " of their own science, the characteristics of wheat which are the ultimate " cause of, or at any rate are correlated with, good baking qualities ".

An interesting paper by Mr. Humphries on the same subject will be found on p. 1164 of the Institute's Agricultural Bulletin for August 1913 (1).

Attention may now be drawn to the conclusions drawn from the experiments of Howard, Leake and Howard in respect to the effect of environment on wheat in India. It is necessary of course to premise a consideration of this subject with the condition that the general character of the climate must be common to all such experiments.

Thus it would, as already indicated, be useless to draw conclusions from the effect of environment in different parts of India where throughout the growth period is short, for application to countries where the growth period is long. Nevertheless some interesting facts were brought out by the experiments in India itself which tend to prove that, to use the words of the Pusa memoir, " no matter what the agricultural conditions were, the milling and baking qualities were little influenced by environment ". It must first be explained that the experiments consisted in trying varieties of wheat-which had been evolved as the most promising and successful at Pusa and Cawnpore. Of these what has been classed as Pusa No. 12 was considered the best (2). It was sent out to experimental stations in various wheat growing regions for trial and, to quote again from the memoir, " Flour, strength and milling qualities " (under Mr. Humphries' tests) were not in the least destroyed by transferring a dry-crop wheat raised at Pusa in the extreme east of the wheat-growing area of India to North Western India (some hundreds of miles distant) or to the (equally distant) black soils of Central India. Indeed the wheat was improved by the transfer ! " A single grade of white wheat " continues the memoir " of improved quality can therefore be grown over a very large part of the wheat produing area of India " without being materially affected by variety of environment.

The details of results at the different stations are perhaps of local interest only, but one point brought out by the trials is of general significance, *viz.* that wheats which were on general appearance entitled to be placed high up on the list of competing samples had when tested for milling and baking qualities, to descend to a much lower place. In one case the last on the list as regards " looks " rose under the tests to the top of it. This is a further proof, if it were required, of the desirability of subject-

(1) *Wheats from the British Millers' Point of View*, by A. E. HUMPHRIES.

(2) Pusa No. 12 has since been found by experiment to withstand rust satisfactorily.

ing all wheats under trial for world markets to these milling and baking tests. Another point brought out by the experiments was that over irrigation was injurious to the quality of the grain. One of the merits of Indian wheats is, as stated in Sir James Wilson's memorandum (p. 27), that they are as a rule " comparatively dry, one reason why they fetch a better price than ordinary British wheats which are naturally moist ". Over irrigation, which often occurs on canal-watered tracts, tends to the production of mottled grains, some parts of which are drier and capable of absorbing more moisture than others. A strong move is being made in some countries embarking in the production of wheat for world markets to make more extended use of irrigation and to them this warning may be useful.

But the one chief lesson to be learned from the investigations dealt with is the very great advantage of proving the behaviour of a competing wheat under milling and baking tests. They also indicate the desirability of giving trial in some other countries to varieties such as Pusa No. 12 which have been evolved by experts as superior in quality and yield to other wheats grown in India.

Forestry in the United States at the Present Day

by

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The land area of the United States is nearly two billion acres. The diversified climate, particularly the great variation in precipitation, results in marked differences in the kind and unevennesses in the distribution of the timber wealth. Nearly one-half of the country was originally prairie or too arid or cold for the growth of commercial timber. The area originally timbered has been reduced by various causes until the land now in forest is approximately 550 million acres, or about 29 per cent of the total area of the country. Much of this has been so badly injured by fire and destructive lumbering that there is no hope for a new crop without artificial regeneration. Recent estimates have placed the forest capital now on the ground at from 2500 to 2800 billion feet b. m., or about one-half of the original stand. Two-fifths is in the extensive coniferous forests of the Pacific coast and another fifth in the pineries of the South. Less than one-ninth is in the Rocky Mountain region. The northern and eastern forest regions are in the most densely populated areas of the country, and originally contained nearly one-half of the total stand. They are rapidly reaching the end of their virgin supplies and are yearly drawing more upon the other forest regions.

For some years all our large sources of timber supply have been drawn upon in order to meet the demands of our lumber markets for domestic

use and for export. Demand has increased until the yearly consumption approximates 23 billion cubic feet of wood of all classes. This includes about 50 billion feet b. m. of sawn and round timber. Domestic consumption reached its maximum about 1910. Since then it has shown but little variation. However, there will be a marked falling off during the present year.

Although numerous desultory efforts were made by individuals and societies to create public sentiment in favor of forestry, it was not until the latter part of the 19th century, or until the rapid lessening of the reserve supply in the virgin forests and the consequent increase in stumpage values were apparent to all, that real progress could be made. The advance in forestry in the United States since then has been very rapid, and a strong public sentiment in favor of the management of forests for a sustained yield has become general throughout the country. This advance has been particularly noticeable in the direction of technical training in forestry and in the organization and management of publicly owned forests. *It is apparent at the present time that further progress in forestry in the United States is seriously handicapped because more than three-fourths of the forests of the country are privately owned with no government regulations regarding management.* How soon and how rapidly forests sufficient to insure future needs will be placed under management for a sustained yield depends chiefly upon ownership. Because of the long time required for forest crops to reach economic maturity, present expenditures cannot be balanced by the sale of forest products for many years after the expenditures are made. Private owners of timber land are tempted to exploit it without regard for future crops, and consequently forest management makes little progress under private ownership.

Forestry education in the United States is a development of the past seventeen years. It began with the great demand for technically trained foresters coincident with the creation of the national forests and the organization of State forests. In response to this demand, twenty-two collegiate institutions now offer undergraduate or graduate courses and purport to give a general training in technical forestry. Fifteen of these institutions graduated 750 men prior to 1914, of whom 591 are now engaged in forestry. The total number of men who have received a technical training in forestry at collegiate institutions in the United States and have obtained degrees is approximately 1100. Nearly one-third of these men were trained at the Yale Forest School, which is the oldest professional forest school in continuous operation in the United States. Approximately forty educational institutions offer short courses in elementary forestry for students studying agriculture and allied subjects. Nine academies, ranger schools, and similar institutions train men for minor positions. In the short space of fifteen years the facilities for technical forestry have developed beyond the present demand for men to organize our forests and place them under management for sustained yield. Since it is extremely doubtful if economic conditions will warrant the extensive organization of private forests for a sustained yield, at least during the present generation, a large propor-

tion of the graduates in forestry must seek employment with private owners of timberland in other fields, namely, in developing more intensive methods of utilization, both in the forest and in the mill, for which the forester's training admirably fits him.

The United States Forest Service is chiefly concerned with the organization and management of 160 national forests, embracing more than 187 million acres. It is also engaged in comprehensive forestry investigations useful to the public at large and in cooperation with the States. The magnitude of the work is best expressed in the annual expenditures and receipts. The average annual expenditure for the past three years was approximately $5 500 000, with little increase from year to year. The annual receipts, for the same period, from timber sales, grazing permits, and special uses were about $2 200 000 and increased from $2 000 000 in 1911 to $2 500 000 in 1913. It is interesting to note that forty per cent of all receipts were for grazing.

When the national forests were first created, the boundaries were imperfectly drawn and much land was included which ought to have been eliminated, while other areas that should have been included were omitted. The readjustment of boundary lines and the elimination and absorption of lands have been in constant progress. The policy of the Service at the present time is to eliminate all lands upon which it is not expected to grow timber unless it is necessary to hold them for administrative reasons.

In 1913 the personnel of the Forest Service numbered 2 895 men. The increase during the past three years has been from one hundred to two hundred men each year, of which number from twenty-five to fifty were technically trained.

The inaccessibility of many of the national forests makes the utilization of the timber impossible at the present time. This has a tendency to force excessive cutting on the more accessible forests in order to make the timber sales at all commensurate with the enormous total stand. The sales in 1913 were approximately two billion feet b. m. All sales are made on the stump and in all large sales a period of several years is allowed in which to remove the timber. The trees are cut under rigid inspection and the methods employed are those most certain to result in restocking the land. As yet, however, there is much groping in the dark, because experience has not demonstrated in all localities the best practice for natural reproduction under the diverse conditions that prevail on the national forests.

The greatest advance in the management of the national forests has been made in the organization and machinery for protection from fire. This is shown in the acreage burned over per thousand acres from 1910 to 1912 inclusive:

1910	19.90 acres
1911	1.76 »
1912	0.91 »

The greatly increased efficiency in the protective work of the Forest Service is largely due to the rapid increase in permanent improvements, the development of fire protective plans, and cooperation with adjacent property owners.

About seven and a half million acres of the national forests have been so completely destroyed by fire and other causes that they can be restocked only by artificial means. Compared with this vast acreage of idle land very little has been done in reforestation, and much of the work is as yet of an experimental nature. Approximately 30 000 acres were seeded and planted in 1913, five-sixths of which was by seeding. The seeding was done at an average cost of $4 per acre, and the planting at an average cost of $11 per acre. The present indications are that less than one-half of the total resulted in successful regeneration. This was chiefly due to the large sowings, a great percentage of which were complete or partial failures. Results to date emphasize the necessity for more extensive planting and the confining of direct seeding to the most favorable sites under thorough soil preparation.

More than twenty million head of stock are dependent upon the national forests, at the present time, for forage during the whole or a part of the year. The importance of this industry, which returns a revenue of approximately one million dollars per year, has necessitated the development of a large grazing department within the Service, which regulates the grazing, declares closed areas, studies the economic forage plants, and protects the stock against disease, wild animals, and poisonous plants. The systematic management of the range has increased the carrying power of many of the forests, *but has emphasized the necessity for the reduction of grazing and often the entire exclusion of stock during periods of regeneration.*

The permanent improvements on the national forests include roads, trails, bridges, fire lines, telephone lines, fences, and buildings. Such improvements cost in 1913 about $200 000. The total improvements to date have a value of approximately $3 500 000. About twelve million horsepower can be developed from the natural stream flow on the national forests. The policy of the Forest Service is to encourage power development, while safeguarding the interests of the using public. The development of this power has been very rapid in recent years and is destined soon to become a factor of vast importance.

The cooperative work with the States has been of great value in stimulating State and private interest in forestry and in developing effective methods of State organization, particularly the control of forest fires. Through section 2 of the Weeks law, the United States Forest Service cooperates with the forestry departments of the several States in the protection of forested watersheds of navigable streams. More than $90 000 were expended by the Federal Government in this cooperative work in 1913. The law has been in operation for three years and the seventeen States that have taken advantage of it afford much better protection to their forests than formerly.

Forestry investigations by the Federal Forest Service, on an extensive and thoroughly systematic plan, are entirely the growth of the past decade. From the investigations now under way, it is reasonable to expect results of far-reaching importance in the near future. These investigations include problems of forestation, mensuration, management, utilization and grazing. A number of well-equipped forest experiment stations are maintained on the national forests. The Wood Products Laboratory at Madison, Wisconsin, equipped and supported by the National Forest Service, is the largest institution of the kind in existence.

Although State and communal forestry lag far behind national forestry, the former is now making rapid progress. Fifteen years ago New York and Pennsylvania were the only States where material progress had been made. To-day twenty-five States have active forestry departments. Fourteen States have established State forests with an area of nearly 3 500 000 acres. The tardy realization of the necessity of removing State and communal forests and the State departments of forestry from administration by political henchmen has seriously hampered development. Conditions in this respect are changing and we are destined to see a rapid development in State and communal forestry in the near future. State forestry has been chiefly concerned in developing efficient fire protective systems. Twenty States are now well organized and are yearly securing larger funds for protective work. Between ten and fifteen million small trees are produced yearly in State nurseries. Much of the stock grown is distributed to private owners at cost. The total appropriations for State forestry, excluding appropriations for educational purposes, were nearly $1 350 000 in 1912. The largest part of the appropriation is for fire protection, although in 1912 nearly half a million dollars were expended for the purchase and maintenance of State forests. Five States have attempted to solve the forest taxation problem within the past three years by enacting legislation which permits the classification of forest land and the placing of the tax largely upon yield. In many of the States the departments of forestry are creating a greater interest in private forestry by publications, correspondence, popular lectures, and by actual field demonstrations.

Municipal and other communal forestry has made only a beginning as yet in the United States. There are approximately one hundred cities and towns that own forests ranging in size from 15 000 to less than 100 acres. Only in exceptional cases are these forests organized for a sustained yield, but such organization will inevitably come within the next few years. Municipal forests in the United States have been acquired, for the most part, for the purpose of protecting the sources of potable waters. These forests are often several thousand acres in area, and the economic advantages derived from managing them for a sustained yield are just beginning to be appreciated. It is the writers' belief that the early future development of forestry in the United States will witness the further creation of State and communal forests. From now on we must look to the States, municipalities, and public corporations for the substantial increase in our public forests.

Although more than three-fourths of all the timberland in the United States and nearly all of the waste land unfit for agriculture but suitable for growing timber is privately owned, the placing of this land under a system of progressive forest management appears to be impossible under present economic conditions. Private forestry has made slow progress in the United States when the vastness of the area involved is considered. Although some private forests are more intensively managed than either national or State forests, the area so managed is so small that it makes little impression upon the whole. The private owners of forest property are chiefly concerned with the protection of the present stand, particularly where such stands are virgin forests. The need for fire protection has resulted within recent years in the organization of thirty timberland owners' fire protective associations. These associations have been a powerful factor in bringing all protective agencies — federal, State and private, into close cooperation. The sixteen associations of the Pacific Northwest patrolled 20 000 000 acres in 1912 and effectively guarded about one-fifth of the nation's timber supply, which is worth at least $1 000 000 000 to the owners. The cost to the associations is from $200 000 to $700 000 per year.

Although private owners appreciate the need for protecting present crops from destruction by fire, as a rule they are not applying modern silvicultural methods to the regeneration and improvement of stands. The departments of forestry of the several States reported in 1912 approximately 3 600 000 acres of private forest under some form of management. Approximately 1 500 000 acres have been planted or seeded with timber trees by private owners in the past. Until two decades ago, however, nearly all the planting was done in the prairie States under a law which gave the settler the title to 160 acres of the unoccupied public domain by planting forest trees upon a part of it. Many of the resulting stands have already disappeared. Planting by private owners, primarily for the purpose of producing a crop of timber, has been done nearly all within the past fifteen years, and chiefly in New England, New York, Pennsylvania, and the Lake States. New York distributed annually from three to five million coniferous trees. These trees are grown in the State nurseries and are distributed at cost to the citizens of the State.

The most encouraging sign of progress in private forestry in recent years is the increase in requests from woodland owners for the inspection of their property by the departments of forestry in the several States. Although the advice given is seldom followed to the letter, it is having increased effect in initiating the parctice of forestry on private lands, particularly in New England.

One familiar with forestry conditions in the United States at the present time is impressed with the progress made in national forestry and forestry education within the past decade. He is disappointed in the progress made in private forestry, but realizes the economic barriers against the general adoption of modern silvicultural methods by private owners of forest pro-

perty except in parts of New England and other restricted regions. He is forced to the conclusion that the greatest forest need is larger State and communal forests and that compact bodies of denuded and unproductive lands unsuited for agriculture but adapted for the growth of timber, should be owned by the States and municipalities or otherwise be under communal ownership.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

RURAL HYGIENE.

568 **Acidity as a Factor in Determining the Degree of Soundness of Maize.** — BESLEY, H. J., and BASTON, G. H. — *Bulletin of the U. S. Department of Agriculture*, No. 102, 45 pp., 1 coloured plate. Washington, D. C., 1914.

The researches of BLACK and ALSBERG (Determination of the deterioration of maize with incidental reference to pellagra. — *U. S, Department of Agriculture. Bureau of Plant Industr, Bulletin* 199, 1910) and of others have established that the degree of acidity found in damaged maize was far greater than in sound and well conditioned maize.

It was for the purpose of ascertaining the range in the degree of acidity of commercial maize and to determine the reliability of the acid test as a criterion of quality and soundness of maize for commercial grading that the present investigation was undertaken.

The method of examination was as follows: a sample of about 100 gms. of maize is ground finely, 10 gms. of the meal are carefully shaken in an Erlenmayer flask with 50 cc. of 80 per cent alcohol, then left to digest for 16 or 18 hours, after which the liquid is filtered and 25 cc. of the clear filtrate to which 75 cc. of distilled water have been added are titrated with a one-hundredth normal alkali solution. The number of cubic centimetres of one-hundredth normal alkali required to neutralize the acid in 10 grams of maize is termed the " degree of acidity ".

The results of the numerous analyses carried out by the writers and collected in tables and diagrams establish clearly the following facts:

All maize, unless in a state of putrefaction, contains a certain degree of acidity.

There is a great variation in the degree of acidity of maize, ranging from 9 or 10 cc. to over 100 cc. The degree of acidity can be determined by the acid test to within 0.5 cc.

The source of the acidity is almost entirely in the germ. The source of increase in the degree of acidity is also almost entirely in the germ.

All maize judged damaged by the eye is higher in degree of acidity than maize judged sound by the eye.

In general the degree of acidity of maize varies inversely with the germination power; it increases directly with the percentage of damaged kernels; it is greatly increased by the action of fermentation and high temperature.

Throughout the year, from harvest to harvest, there is a gradual increase in the degree of acidity and a corresponding decrease in the percentage of germination of maize.

The degree of acidity of maize is a criterion of soundness and quality.

From the standpoint of commercial grading, maize with a degree of acidity less than 22 cc. is normally sound and of good commercial quality; maize with a degree of acidity between 22 and 26 cc. is somewhat inferior in quality and soundness, due to deterioration of the germ; maize with a degree of acidity between 26 and 30 cc. evidences marked deterioration and is unsound, and that with a degree of acidity greater than 30 cc. is badly damaged and of a very low quality.

569 – **Work of the Hawaii Agricultural Experiment Station in 1914.** — *Report of the Hawaii Agricultural Experiment Station*, 1914, 73 pp., 3 plates. Washington, D. C., February 20, 1915.

ORGANISATION OF EXPERIMENTAL AND ANALYTICAL WORK

The present is a summary of the most important results obtained at the Hawaii Agricultural Experiment Station during the past year :

I. — The effects of heat were studied on twelve different soils of varying types, the soils being heated to 100 and 250° C. and to ignition (1). On the whole the effect of heating was to render plant food compounds and other compounds more soluble. The most important effects of heating soils are apparently included in the processes of flocculation, oxidation, double decomposition and alteration of soil elements. There was a slight loss of total nitrogen from heating. One of the striking effects was the unusually rapid formation of ammonia after the soil had been heated. Heating soils seems to bring about rapidly the effects which are otherwise obtained more slowly by aeration. All the plants experimented upon grew much more rapidly on heated than on unheated soils.

II. — The investigation of the nature of nitrogen compounds in the soil has been continued. The results thus far obtained indicate that bacteria cause more rapid decomposition of the diamino acids than of the other groups present in protein.

III. — In heavy clay soils all fertilisers used alone or in mixtures at the ordinary rate have been found to check the movement of soil moisture. Sodium nitrate increased the water-holding power of soils and also increased

(1) See *B.* April 1914, No. 315; April 1915, No. 350. (*Ed.*).

the rate of percolation of the water; corresponding with this there was a diminution of the capillary rise of moisture. Capillarity was found to be greatest in silty soils, less in sandy soils, and least in heavy clay soils. The increase in the concentration of the fertiliser salts caused a diminution in the capillary movement of water. In ordinary soils all fertilisers diminished the percolation of water through the soils. Salts of calcium and magnesium checked percolation less than salts of sodium, potassium and ammonium. In clay soils chlorides were found to check the flow of water less than sulphates, while the reverse proved to be true in the case of organic soils. In each case the soil which showed the greatest capillarity offered the greatest resistance to the percolation of water. It was demonstrated that fertilisers exert physical effects which are perhaps more easily detected and measured than are chemical effects.

IV. — In a study of the function of fertilisers in soils it was found that phosphoric acid was fixed to a greater extent than other fertilisers. This fertiliser proved most effective when applied in the most soluble form. While, however, phosphoric acid in soluble form was fixed in the soils to an almost indefinite extent, it still remained readily available to plants, as shown by the decided residual effect of phosphoric acid upon three successive crops. Ammonia was fixed to a greater extent than potash, but was less firmly held by the soil, and may become available more promptly. Nitrates were not fixed by Hawaiian soils to any appreciable extent. It was found that there was less loss by fixation in the soils when fertilisers were applied singly than when they were applied in combination. More deflocculation took place, however, when fertilisers were applied singly.

V. — Continued study of the lime-magnesia ratio in Hawaiian soils brought additional evidence that this ratio is not important in itself. It only becomes important when soluble salts are in great excess or when the soil solution is greatly concentrated and the mineral matters are out of normal proportion.

VI. — Volatile antiseptics and heat were found to increase ammonification for a period of two weeks. Nitrification then began after about three weeks and gradually increased to a maximum. Volatile antiseptics in experiments did not kill protozoa, which were easily killed by heat. The evidence accumulated is against the possibility of protozoa being connected with nitrification in soils.

VII. — It was shown that legumes used as green manure greatly increased the availability of rock phosphate.

VIII. — Experiments with fertilisers on the yield of rubber. *Manihot glaziovii* showed that the best results on the growth of the rubber trees and on their yield in latex were obtained with superphosphate and potassium sulphate without the addition of any form of nitrogen.

It has been observed that by means of cuttings from good yielders among *M. glaziovii*, whole plantations may be made in which all the trees will be large yielders.

IX. — Though no chemical differences were noted in the composition of perfectly ripe coffee berries and half ripe ones taken four or five

days before complete maturity, yet the coffee prepared for drinking from unripe berries was found the best. As a result, coffee growers in Hawaii are picking their fruit a little greener than heretofore, thus avoiding also the excessive infestations of the fruit fly.

X. — In experiments at the station it was found that if in the early morning a dozen shallow incisions one-half to three-quarters of an inch apart are made lengthwise in a papaya fruit of good size, enough juice will be obtained to make half an ounce of dry papain. Fruits may be tapped on alternate days five to seven times in all. As soon as the fruit begins to turn yellow the milky juice flows less freely. The tapping wounds heal quickly and the flavour of the fruit appears to be somewhat improved, since a slight bitterness which characterises the juice is thereby removed. It has been found that the papain is injured if the juice is allowed to come in contact with any metallic substances; the tapping must therefore be done with a glass, bone or ivory instrument, and the juice collected in earthenware vessels and promptly dried. It is estimated that papain to the value of $2 can be taken from each tree annually.

Breeding and selection work is being carried out on the papaya with the object of eliminating the staminate plants. Two hermaphroditide flowers were fertilised with their own pollen and from the seed thus obtained 454 trees in the F_2 generation have been bred, 95.37 per cent of which are fruit bearing. Two staminate trees of F_2 were headed back, and they produced branches bearing hermaphrodite flowers and then perfect fruits.

XI. — Arsenite of soda has come into general use for the destruction of weeds in rubber and sugar plantations. Experiments are being carried out in order to determine the fate of arsenite of soda in the soil and its possible effect upon nitrification and upon the physical properties of the soil. In pot experiments, when arsenite of soda was added to the extent of 0.25 per cent of the soil, it was found to cause a pronounced deflocculation. The amounts used for spraying purposes thus far have shown no effect upon the soil.

XII. — The hen flea (*Sarcopsylla gallinacea*), which is found on chickens, rats, cats and perhaps other animals, appeared in Honolulu. Among the various remedies tried, carbolated vaselin (containing 2 per cent of carbolic acid) and a 3 per cent solution of carbolic acid proved the most successful. Kerosene and Zenoleum killed about 75 per cent of the fleas.

CROPS AND CULTIVATION.

570 — **The Organisation of the Meteorological Office in London with Special Reference to Agricultural Meteorology**. — *Advance Minutes of the Meteorological Committee.* London, January 27, 1915. AGRICULTURAL METEOROLOGY

The meteorological services in Great Britain are financed partly by State grant (£ 21 000 per annum) and partly by municipal and private contributions, making up a total expenditure of about £ 50 000 per annum. Administration is in the hands of the Meteorological Committee, while the

Meteorological Office represents the central organisation and consists of a central office, with branch offices, observatories and stations.

The work of the Meteorological Office, which originally consisted only in the collection and discussion of observations from the sea, has gradually been extended till it now comprises marine meteorology, general forecasting and dynamical meteorology, climatology and statistics, as well as special divisions for instruments and equipment, a library and information bureau. Rainfall, however, still remains the care of a private organisation and the Meteorological Office makes no attempt at the detailed representation of rainfall, but only deals with rainfall as part of climatology.

With regard to agricultural meteorology, it is an open question whether the responsability for the application of meteorology to agriculture belongs to the Meteorological Office or to the respective government agricultural departments in England, Scotland and Ireland. The traditional attitude of the Meteorological Office is that it collects and digests meteorological information which the agriculturist can apply if he wishes, and to this end it issues a Daily Weather Report with the previsions set out for telegraphing forecasts for a small fee to those who are willing to pay for the telegrams; these forecasts are prepared thoughout the year at 10 a. m. and 7 p. m., and during the harvest season (June to September) also in the afternoon specially for agriculturists. Weekly and monthly weather reports are also issued.

In actual practice these provisions are very little used by agriculturists. The farmers are unwilling to pay for the telegrams until the value of the forecasts has been definitely proved; yet that can only be done by trial, and nobody has been found who will pay the cost of an adequate trial on a large scale. With regard to climatological work, the Meteorological Office commits a vast number of figures to print without knowing their precise application to agriculture. In this connection, too, more experimental work is required. The further application of meteorology to agriculture is largely dependent upon education in the rural schools, where the study of weather is now becoming a part of the curriculum.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

571 – **The Atmosphere of the Soil: Its Composition and the Causes of Variation.** — RUSSELL, E. J., and APPLEYARD, A., in *The Journal of Agricultural Science*, Vol. VII, Part 1, pp. 1-48. Cambridge, March 1915.

The apparatus used for investigations on the atmosphere of the soil was one devised by HALL and RUSSELL in previous work on the same subject. It consists of a hollow cylindrical steel tube fitted with a cylindrical ram-rod and connected to a mercury reservoir. The samples of gas are collected over mercury in thick glass test tubes of about 30 cc. capacity. The soil from which all these air samples were taken is a heavy loam with many stones. It becomes sticky when wet but can be got into a good crumbly tilth as it becomes drier. The samples were taken at a depth of 6 inches, since this is the region where the soil changes take place and preliminary investigations showed that no great difference in composition occurred on going deeper.

The writers summarise their work as follows: The free air in the pores of the soil to a depth of 6 inches is very similar in composition to

the atmospheric air, but differs in two respects, *viz.*: *a*) it contains more carbon dioxide and correspondingly less oxygen, the average in 100 volumes being 0.25 volume carbon dioxide and 20.6 of oxygen against 0.03 carbon dioxide and 20.96 oxygen in atmospheric air; *b*) it shows greater fluctuations in composition.

Usually the sum of the percentages of carbon dioxide and oxygen is slightly less than in atmospheric air, but at periods when nitrates rapidly increase there is a perceptible falling-off of oxygen, which becomes greater in water-logged soils. Besides this free air, there is another atmosphere dissolved in the water and colloids of the soils, consisting mainly of carbon dioxide and nitrogen and with practically no oxygen. This air is obtained in the later extractions, which ultimately consist of almost pure carbon dioxide.

The fluctuations in composition of the free soil air are mainly due to fluctuations in the rate of biochemical change in the soil, the curves being similar to those showing the amount of nitrate and the bacterial counts as far as they were taken. The rate of biological activity attains a maximum value in late spring and again in autumn, and minimum values in summer and winter. In autumn the bacteria increase first, then the carbon dioxide rises and finally the nitrate increases. From November to May the curves closely follow those for the soil temperature, which thus appears to be the dominating factor, from May to November they follow the rainfall, and to a less extent the soil moisture curves. The distinct difference between rainfall and soil moisture indicates that rainfall does something more than add water to the soil. It is probable that the dissolved oxygen is a factor of considerable importance in renewing the dissolved soil atmosphere and facilitating biochemical change (1).

Grass land usually contains more carbon dioxide and less oxygen than arable land but the difference cannot be attributed to the crop owing to the large differences in soil composition and conditions. It is difficult to ascertain the precise effect of a crop, but as the soil differences are eliminated so the differences in composition of the soil air become less and less. No evidence could be obtained that the growing crop markedly increases the amount of carbon dioxide in the soil air, and if it gives rise to any great evolution of carbon dioxide in the soil it apparently exercises a corresponding depressing effect on the activities of soil bacteria. This result agrees with one obtained earlier in reference to the nitrates in the soil (2).

Such weather conditions as barometric pressure, wind velocity, variations in temperature from the mean, small rainfall, etc., seem to have but little effect on the soil atmosphere.

(1) See also *B.* Feb. 1914, No. 119. (*Ed.*).
(2) See *B.* April 1914, No. 314. (*Ed.*).

572 – **Studies on the Formation of Silts and their Deposition by Water in the French Alps and Pyrenees**. — MÜNTZ, A., and LAINÉ, E., in *Comptes rendus de l'Académie des Sciences*, Vol. 160, No. 15, pp. 462-467; No. 16, pp. 491-495. Paris, April 12 and 19, 1915.

The Formation and Transport of Silts in the Alps and Pyrenees. — The writers were deputed by the Department of Agricultural Improvements of the Ministry of Agriculture to undertake researches on the materials carried by the watercourses of the Alps and Pyrenees. For this purpose they organised 25 stations on the principal watercourses and recorded observations during two consecutive years.

In the first place they confirmed the necessity for extreme care in the construction of barrages for reservoirs on certain watercourses in the Alps, owing to the danger of rapid silting-up.

They then determined the physical composition of the materials in suspension and studied the manner of deposition with the slackening current. They also determined the properties of the soils derived from these materials by natural deposition and by warping, and the changes they produce on agricultural land when deposited by irrigation.

The first observation was that the mass of materials brought from the mountains by running water either in solution or in suspension varies considerably according to the geological nature of the source. Generally little material is obtained from the older formations, whilst in recent formations rapid erosion takes place: thus, the streams of the Pyrenees contain less silt than those of the Alps, except those of the ancient massifs near Mont Blanc.

The composition of the more important rivers is given in Table I.

Naturally a large part of the suspended material is deposited as the velocity of the rivers slackens. Thus it will be noted that the Isère loses half its silt between Montmélian and Grenoble, a distance of only 35 miles.

By means of KOPECKY'S apparatus, with SCHLOESING'S method for determining the clay, it is possible to separate the silts into the categories shown in Table II.

This method of separation shows that the physical constitution of the silts is in direct relation to the speed of the current. They are coarser during floods and become finer further from the mountains. Thus the material in the Glandon (a mountain tributary of the Isère) contains 16.4 % of gravel, 47.7 % of "sand", 34.5 % of "silt" and 1.4 % of clay; the material of the Upper Isère (Montmélian) contains no gravel, 47.0 "sand", 50.6 "silt" and 2.4 clay; while at Grenoble the Isère silt contains only 8.4 "sand", against 87.6 "silt" and 4.0 clay. For this reason, irrigation water should pass along a considerable length of canal to let the silt deposit before it is distributed in the zone of irrigation, the sedimentation being more even in such canals than in the bed of the river.

The denudation in the Isère and Durance basins in Savoy is considerable. The Isère at Montmélian receives the rainfall of an area of about 1870 sq. miles in the Alps; during the two years 1911-13 the average annual removal of silt was 38½ million tons, or 20 000 tons per sq. mile; distributed evenly

TABLE I. — *Materials transported by the Isère, Durance and Garonne.*

Watercourse	Year	Average flow, in cubic ft. per sec.	Materials			
			in suspension		in solution	
			weight per 1000	transported annually, tons	weight per 1000	transported annually, tons
Isère at Moutiers	1911–12	1 144	0.180	181	0.504	507
» » »	1912–13	1 158	0.064	65	—	—
Isère at Montmélian	1911–12	5 579	7.630	38 200	0.497	2 480
» » »	1912–13	6 385	6.987	39 200	—	—
Isère at Grenoble	1912–13	7 032	3.173	19 600	0.345	2 140
Durance at Embrun	1911–12	2 836	0.347	867	0.348	867
Durance at Sisteron	1911–12	5 450	1.493	7 180	0.325	1 555
» » »	1912–13	4 577	1.351	5 460	—	—
Durance at Mira eau	1911–12	8 639	0.983	7 500	0.338	2 570
» » »	1912–13	9 267	2.296	18 700	—	—
Garonne at Saint-Béat	1911–12	805	0.045	32	0.137	97
Garonne at Toulouse	1911–12	5 220	0.074	340	0.155	709
» » »	1912–13	6 650	1.203	7 040	—	

TABLE II. — *Mechanical analysis of Silts.*

Class		Diameter of particles.	Speed of fall per sec.
		mm.	mm.
Gravel		more than 1.00	
Sand	coarse	1.00 — 0.50	more than 7
	medium	0.50 — 0.25	
	fine	0.25 — 0.10	
Silt	sandy	0.10 — 0.05	7 — 2
	fine	0.05 — 0.01	2 — 0.2
	very fine	less than 0.01	less than 0.2
Clay		impalpable	

throughout the basin of the river, this silt would form a layer of 8 mm. per annum, equivalent to a lowering of the mountains by 81 cm. (32 inches) per century. The Durance carries down only 2900 tons of material per

sq. mile, corresponding to a layer of 7.8 cm. (3.05 in.) per century over the basin of the river. The greater part, however, being very fine silt, is carried down to the sea, except what is turned into the irrigation canals, whilst the silt of the Isère, being heavier, is deposited sooner.

Agricultural value of silts deposited by streams from the Alps and Pyrenees. — In chemical composition, the silts are almost identical with average arable soils:

	Per thousand
Nitrogen	0.7 — 1.2
Phosphoric acid	0.8 — 1.5
Potash	1.5 — 2.0

The specially fine and clayey silts contain up to 3 or 4 per thousand of potash, and are also rich in lime. Deposits of silt may thus form fertile soils. They may improve less fertile land by means of their fertilising elements, as well as by increasing the body and depth of the soil; but they are not likely to increase appreciably the reserves of fertility of irrigated soils, which are generally rich and heavily manured.

Considering that the agricultural value of silt consists chiefly in the fact that it changes the physical constitution of the soils, which is of great importance for irrigated land, it was deemed advisable to determine the physical properties of silts with a special laboratory apparatus. The soil is placed in a brass tube closed at its lower end by a fine metal gauze; it is moistened and then allowed to dry in contact with an air-dried sample of the same soil. During these operations, carried out during equal periods, the soil is subjected to a constant pressure. The following determinations are then made by weighing: *apparent density*; *porosity*, or volume of air space; *water capacity*, or the imbibition water remaining in the dry soil expressed in volume and weight; *air capacity*, or volume of space not occupied by water in the re-dried soil (this is a measure of the degree of aeration of the soil); *permeability*, or the rate of filtration of water. These physical properties are very important for irrigated soils, since they have a greater influence on the fertility than the chemical composition. In fact irrigation only gives satisfactory results in soils with a sufficient capacity for water and air, and an average permeability, properties which depend on the physical constitution of the soils. Table III contains the data concerning the physical properties and composition of some silts from the Isère and Durance.

The greatest variations occur in the permeability, which diminishes according to the degree of fineness until the soil becomes almost or even quite impervious, as in the case of the silt of irrigation canals. Similarly the air capacity diminishes, until the soil becomes asphyxiating to the plant. The water capacity, on the contrary, increases with the fineness of the particles; but it never becomes very great, owing to the small amount of colloidal clay contained in silts.

The silt carried by irrigation water forms soils with an average capacity for water, but at the same time compact, asphyxiating, and impermeable;

TABLE III. — *Silts of Isère and Durance.*

Silts carried by:	Mechanical composition								Physical properties				
		Sand			Silt					Capacity for			
	Gravel	coarse	medium	fine	sandy	fine	very fine	Clay	Porosity	water by volume	water by weight	air	Permeability, cm. per hour
Isère at Montemélian . .	0	0.8	23.2	23.0	31.4	17.1	2.1	2.4	50.4	25.0	18.4	25.4	3.3
» at Grenoble	0	0.3	4.2	3.9	16.7	40.6	30.3	4.0	55.7	41.8	27.8	13.9	0.3
Durance at Sisteron. . .	0	0	0.1	0	0.7	13.6	64.8	20.8	47.3	35.2	24.4	12.1	0.0004
» at Mirabeau:													
flood of June 2, 1912 .	0	0	3.5	7.0	40.5	30.5	14.0	4.5	46.6	29.6	21.1	17.0	0.5
» October 22, 1912.	0	0.1	0.2	0.1	0.8	0.7	76.9	21.2	50.6	45.7	35.2	4.9	0

it also tends to produce these defects in irrigated lands. The amount of silt added by irrigation water is in some cases considerable. Thus, from samples collected by PROST, it has been found that the irrigation water of the Carpentras canal carries a sediment of 0.967 parts per thousand; with a depth of irrigation water of 8 ft., this would give 10 tons per acre per annum of silt, equivalent to an increase in depth of soil of 1.7 mm., or 17 cm. (6 ½ inches) per century. According to BAROIS the periodic flooding of the Nile gives an annual layer 1 mm. thick.

The silt deposited by some ancient canals has produced great changes in the physical properties of the irrigated soils. The data in Table IV relate to samples of soil taken by PROST on land irrigated by certain Spanish canals dating from the Moorish occupation, and also to samples taken by the writers on land irrigated by the Saint Julien Canal since the 15th century, as well as to neighbouring lands not irrigated.

TABLE IV. — *Comparison of irrigated and non irrigated soils.*

Locality	Irrigation	Mechanical composition				Physical properties			
		Silt			Clay	Capacity for water		Capacity for air	Permeability
		sandy	fine	very fine		by volume	by weight		
Benimanet (Spain)	Acequia Real de Moncada	14.4	17.8	32.4	15.0	35.1	24.4	9.5	0.06
	None	30.9	16.8	16.0	7.5	24.2	15.6	17.3	0.46
Benifayo (Spain)	Acequia Real de Jucar	15.3	16.2	23.6	19.7	34.5	24.3	11.5	0.10
	None	20.3	17.1	13.7	10.3	27.5	19.0	16.7	0.42
Cavaillon (France)	Canal de St. Julien	6.3	10.6	41.2	12.3	—	—	—	0.3*
	None	11.6	10.5	23.7	13.8	—	—	—	20.4*

* Permeability determined in the field.

It is seen that continued irrigation with muddy waters increases considerably the proportion of the fine particles in the soil, which becomes more compact, less aerated and above all less permeable. As the writers have already shown that lands of low permeability require less water for irrigation, it is possible to economise the water on soils irrigated for some time with muddy water.

This change in the constitution of the soils is not followed by an increase in fertility ; the sedimentation has an unfavourable influence on soils of good quality ; but, owing to the slow rate of deposition, this change takes place so slowly as to be imperceptible.

In other cases sedimentation may transform sterile soils into very productive ones, entirely created by warping, as is the case in the plain of the Crau in France.

573 – **A Manometer Method of Determining the Capillary Pull of Soils.** — CANNON W. A., in *The Plant World*, Vol. 18, No. 1, pp. 11-13. Tucson, Arizona, January 1915.

By this method the capillary pull is measured by the reduction in pressure in the closed arm of a manometer connected with the soil container.

The apparatus consists a ' T '-shaped glass tube having a threeway cock, and of a mercury manometer, a reservoir and a soil container, each of which is connected to a limb of the cock by means of a rubber tube. The reservoir is filled with water and the stop-cock adjusted so as to allow all the tubes and connection to fill with water. A small plug of cotton wool is placed in the bottom of the soil container to prevent the escape of the soil.

The container is filled with soil and the stop-cock turned so as to connect it with the reservoir. The levels of the container and reservoir are adjusted so that water flows into the container and the soil is stirred with a small glass rod to prevent the collection of air bubbles. When the soil appears to be uniformly settled the cock is turned so as to cut off the flow of water from the reservoir and to connect the container with the manometer. The position of the mercury is then observed, the uppermost point reached by the mercury being considered the measure of the capillary pull of the soil under the conditions of the test.

The great objection to this method is the difference in the compactness of the soils when placed in the container. This error is reduced to some extent by the settling under water and can be still further minimised by repeating the tests.

574 – **The Absorption of the Ultra-Violet and Infra-Red Rays by Arable Soil.** — TRISTAN I. FIDEL and MICHAND GUSTAVE in *Archives des Sciences Physiques et Naturelles*. Year CXX, Vol. XXXIX, No. 3, pp. 270-273, 1 Plate, Geneva, March 15, 1915.

The writers have examined the relative values of the absorption of the solar rays of the two invisible ends of the spectrum on the part of the four principal types of arable soil (calcareous, sandy, clayey and humous), both in a dry and in a damp condition. They employed the photographic method. In order to isolate the ultra-violet end of the solar spectrum, the light was filtered through a quartz lens covered with a very thin film of silver (Foucault filter) which made the photographic objective.

The Foucault filter only allows the last ultra-violet rays which are present in the solar light at sea-level to pass through). A Wood filter was used to separate the infra-red rays from the solar light. The photographic plates were rendered sensitive with alizarin blue S.

The photographs thus obtained show that infra-red light is much less absorbed by damp soil of all four types than by dry, and that the soils absorb these rays in the following ascending order: calcareous, clayey, sandy, humous. The ultra-violet light also is less absorbed by damp than by dry calcareous soil, but the difference is less for sandy soil and becomes imperceptible in the case of humous and clayey soils. The intensity of absorption is least in the case of calcareous soil, which is followed by sandy soil, while it is greater for humous and clayey soils. The difference of behaviour towards the rays of the two invisible ends of the spectrum is greatest in dry clayey soil: while this absorbs ultra-violet light very readily, it absorbs very little infra-red light.

575 – **The Radio-Active Content of Certain Minnesota Soils.** — SANDERSON, J. C., (University of Minnesota), in *The American Journal of Science*, Vol. XXXIX, No. 232, pp. 391-397. New Haven, Conn., April 1915.

A method was devised by which the radium content of a soil could be determined from a sample of about fifty pounds. Using this method and one described in a previous paper (1) for the estimation of the thorium content of soils, thirteen typical Minnesota soils were investigated and their radio-active content was determined. Without exception all the very fertile soils were found to be richer in radium and thorium emanations than the soils of inferior fertility.

576 – **The Nitric Nitrogen of the Black Soils of the Arid Regions of Russia.** — TOULAIKOFF N. M. (Director, Besentchuck Agricultural Experiment Station), in *Selskoye Khosiaistvo Liesovodstvo* (Rural and Forest Economy), Vol. CCXLVII, pp. 35-65. Petrograd, 1915.

The question of the nitric nitrogen of the black soils (chernoziom) is one of the fundamental problems of Russian agriculture and its general characteristics have been sufficiently studied. Thus, it has been ascertained that farmyard manure and other nitrogenous fertilizers have not given the results expected of them. In fact, while dung has a positive action, this is by no means proportional to the amount of nitrogen contained in it. Artificial nitrogenous fertilisers often give even negative results, thus accentuating the unfavourable effect of the very large quantities of nitrogenous substances present in the soil (excessive development of straw, etc.).

The Besentchuk Agricultural Experiment Station (Province of Samara), wishing to study the question in more detail, began to devote its attention to the problem of the nitric nitrogen of black soils in the year 1910, and now the writer is publishing the results of these researches of the last five

(1) *The American Journal of Science*, Vol, XXXII, p. 169, 1911.

years (1910-1914) as he considers them sufficient to allow of certain conclusions being drawn.

Method of research. — The soil samples are taken to a depth of 25 cm. (10 in.) at five spots at equal distances along the length of each plot ; the five lots are then carefully mixed and serve for the extraction of samples for the determination of moisture and nitrates (for the latter determination 400-600 grams are taken). The subsoil samples (25 to 50 cm, - 10 to 20 in.) are taken in the same way. Two samples for each determination are taken to the laboratory and dried at once, those for nitrate determination spread out on paper in a closed room and those for moisture determination in the oven. The determination of the nitrates is carried out in the autumn when the field work is finished, the dried samples being kept in rather coarse paper.

One of the principal questions regarding winter crops in the region studied (south-east of Russia-in-Europe), is that of the time and method of breaking up the fallow land. The researches of the Experiment Stations of south and south-east Russia have established in this connection that there exists a certain relation between the time of breaking up the fallow and the amount of the crop. This relation, as a general rule, is as follows : the sooner the fallow is ploughed, the larger is the yield of the winter crops. The first researches suggested that this was due to the different amount of humidity accumulated in land ploughed at various times ; the present researches, however, show clearly that there is a definite relation between the accumulation of nitrates and the amount of the crop.

The experiments were carried out on unmanured fallow, manured fallow, and land under winter grain ; the unmanured fallow comprised four different kinds, *viz.*, so-called " black fallow " land (not ploughed till autumn), and April, May and June fallows (the land being ploughed about the 20th of the respective months). Four to six days after ploughing begins, samples are taken for the determination of the nitrates ; the second time they are taken about the 10th of every month, and after the sowing of the grain only once a month. The following table gives the average figures for the five years of nitrates found in each kind of fallow land. All the land was ploughed to a depth of 7 inches.

Under farming conditions, the accumulation of nitrates in fallow land begins from the moment of ploughing, and, in general, as soon as the soil is well broken up (black fallow), or in other words, when it gets propertly aerated. Aeration is evidently more important than the temperature of the soil, at least at the beginning of the accumulation of nitrates.

On the basis of his researches, the writer draws the following conclusions :

1. The black soils of the arid zone of the province of Samara (and of other provinces under similar conditions) possess a very strong capacity of nitrification ; under favourable conditions of tilth, and when there is sufficient moisture and a high enough temperature, the action of the nitrifying bacteria may become very pronounced, and large quantities of nitric nitrogen may accumulate.

Nitric nitrogen in different fallows

Five-year averages in mgms. of N_2O_5 per kg. of dry soil.

	April		May		June		July		August	September	October	November
	beginning	end	beginning	end	beginning	end	beginning	end				
First 10 *inches*												
Black fallow . .	16.75	25.51	35.10	37.06	47.55	57.65	77.72	82.79	75.32	38.68	33.92	22.25
April » . .	14.96	19.24	32.96	40.89	42.89	52.94	66.32	67.51	60.52	49.40	29.87	21.86
May » . .	15.09	20.89	17.89	18.98	28.23	52.27	68.69	52.87	41.99	28.92	34.82	27.79
June » . .	14.75	18.85	21.48	13.09	17.75	15.16	25.03	28.76	35.85	17.18	22.63	18.37
Second 10 *inches*												
Black fallow . .	19.87	16.12	17.16	19.80	28.87	31.65	25.72	28.90	33.78	25.36	22.63	14.44
April » . .	14.26	18.80	13.77	19.02	25.98	21.63	25.67	27.34	42.28	21.61	15.79	9.72
May » . .	12.73	12.89	16.76	14.36	15.00	16.68	20.78	30.81	33.66	29.40	27.72	23.18
June » . .	15.98	13.81	15.91	15.07	13.69	5.47	7.41	12.26	13.82	12.20	10.42	8.90

2. The largest amount of nitric nitrogen is accumulated in fallow land towards the commencement of August, in the case of autumn-ploughed fallow. Further, the sooner the fallow is ploughed in spring, the more nitric nitrogen accumulates in the ground.

3. The depth to which regularly cultivated fallow land is ploughed has not much importance as regards the accumulation of nitrates.

4. Manuring the soil with dung only increases to a very small extent the amount of nitrates as compared with unmanured fallow.

5. In plots occupied by winter cereals, the quantity of nitric nitrogen decreases very rapidly. The greater part is used by the growing winter rye or wheat ; most of the rest is evidently transformed into compounds insoluble in water, while finally a very small part may be transported to the deeper layers of the soil (below 20 inches).

6. The breaking up of the soil after the harvest of winter cereals gives an opportunity, under favourable meteorological conditions, for the accumulation of a large quantity of nitrates towards the end of September even if at harvest time there was a very small amount of these compounds in the soil.

7. The accumulation of nitrates in the soil, under the conditions obtaining in the black soil regions of Russia, is much facilitated by the fact that all the measures taken by the agriculturist to accumulate water in the soil — water being the most important element for the life of plants in the arid districts — conduce at the same time to the accumulation of nitrates.

577 – **The Lime-Magnesia Ratio and the Effects of Calcium and Magnesium Carbonates on Ammonification and Nitrification.** — KELLEY W. P. (Hawaii Experiment Station, Honolulu), in *Centralblatt für Bacteriologie, Parasitenkunde u. Infections-Krankheiten*, Vol. 42, N° 17–18, pp. 519-526, and N° 21-22, pp. 577-582. Jena, December 1914.

In view of the abnormal lime-magnesia ratio in Hawaiian soils and the large amounts of magnesian limestones being applied to soils in America, the effect of this ratio on the nitrogen transformation in soils is of considerable practical importance.

1. *Ammonification Experiments.*

In these experiments dried blood and soy bean cake meal were used in the proportion of 2 per cent of the air dried soil.

The results are given in the following table;

Carbonate added	Silty loam 9.74 % Mn_3O_4		Sandy loam 9.42 % MgO		Sandy loam, much organic matter		Yellow clay soil		Clay loam		Silty loam		Clay loam	
	Dried blood	Soy bean cake	Dried blood	Soy bean cake	Dried blood	Soy bean cake	Dried blood	Soy bean cake	Dried blood	Soy bean cake	Dried blood	Soy bean cake	Dried blood	Soy bean cake
None	51.9	99.1	156.9	94.1	53.4	74.3	39.3	78.1	94.4	98.3	45.9	79.9	31.0	77.0
1 gm. $CaCo_3$	54.4	103.7	160.3	97.2	52.6	79.5	42.0	80.0	118.1	93.1	—	—	27.2	83.2
2 gm. $CaCo_3$	55.4	104.8	158.9	99.5	64.4	82.4	42.7	82.5	126.2	93.2	46.7	90.0	30.8	87.0
4 gm. $CaCo_3$	56.1	103.4	160.1	96.8	61.3	88.9	44.3	88.9	116.6	95.4	—	—	31.3	84.0
1 gm. $MgCo_3$	68.0	104.1	175.0	93.8	68.6	78.5	53.6	95.1	119.8	94.5	—	—	42.1	83.6
2 gm. $Mg.Co_3$	70.9	103.6	163.8	95.0	93.6	82.7	67.6	98.9	89.6	94.1	60.7	91.7	50.0	85.7
4 gm. $Mg.Co_3$	65.9	98.7	172	92.3	109.9	92.5	73.5	100.8	82.8	89.9	—	—	38.3	80.7
2 gm. $CaCo_3$ + 2 gm. $Mg.Co_3$	69.8	101.3	—	90.7	—	86.8	68.9	97.3	102.6	91.3	61.6	91.6	46.5	90.9
4 gm. $CaCo_3$ + 4 gr. $MgCo_3$	70.9	104.8	—	92,4	98.7	83.4	67.6	95.9	99.7	92.4	62.2	97.7	52.4	91.1

All the soils used originated from basaltic lava and are typical laterites. Most of them contain an excess of magnesia over lime.

In the cases where magnesium carbonate produced stimulation the further addition of calcium carbonate was without effect, whilst in the one instance where magnesia proved toxic the addition of calcium carbonate seems to have overcome the toxicity. Since these results are contradictory of previous results obtained in the case of a sandy Californian soil in which magnesium carbonate depressed ammonification, experiments were conducted to test this point further. The ammonifying power of a sandy soil containing large amounts of coral limestone was tested with dried blood in the presence of different quantities of calcium and magnesium carbonates. Ammonia-free air was passed through the soil and washed in sulphuric acid

so as to determine the amount of volatile ammonia produced. The results are as follows :

Soils	Carbonate added	Ammonia N in soil	Ammonia N volatilised	Total
1 and 2	2 gms $CaCo_3$	62 mgs.	14.1	76.1
3 » 4	2 gms MgCo	39.5	19.8	59.3

Thus, although the amount of ammonia volatilised was greater, the depressing effect of the magnesium carbonate is real and not merely due to the increased decomposition of ammonium compounds as suggested by ASHBY. Experiments with limestone and dolomite showed effects very similar to those produced by calcium carbonate and have no comparison with those produced by magnesium carbonate.

II. *Nitrification Experiments.*

Eight different soils were used and their nitrification was tested with dried blood, soy bean cake meal and ammonium sulphate.

The results obtained are shown in the following table :

Carbonate added	Soil 288 heavy clay. MgO 7.94 % CaO. 1.10 %	Soil 292 clay with small amount of CaO and MgO.	Soil 329	Soil 428 sandy loam with much organic matter	Soil 448 yellow clay soil	Soil 485 silty clay loam	Soil 514 highly manganiferous silty soils	Soil 515 highly manganiferous silty soils
SERIES I. — *Dried Blood* (*2 gms per 100 gms of soil*).								
Control (none)	12.4	9.6	20.0	3.2	6.2	4.8	28.0	6.5
2 gm. $Ca Co_3$	12.5	11.0	19.7	3.6	10.4	2.5	37.0	5.2
2 gm. $Mg Co_3$	7.0	5.9	18.0	2.5	6.9	1.2	3.5	1.1
3 gm. $Ca Co_3$ + 2 gm. $Mg Co_3$	7.2	5.8	17.7	2.7	6.5	1.3	4.2	1.1
SERIES II. — *Soy Bean Cake Meal.* (*2 gms per 100 gms of Soils*).								
Control	16.2	16.7	21.7	4.5	15.0	45.0	61.0	16.4
2 gm. $Ca Co_3$	19.5	14.7	21.0	5.2	22.2	67.0	94.0	11.4
2 gm. $Mg Co_3$	9.3	18.2	19.2	4.4	19.0	3.9	15.2	4.1
2 gm. $Ca Co_3$ + 2 gm. $Mg Co_3$	13.2	18.0	19.5	2.7	15.0	4.3	13.5	4.1
SERIES III. — *Ammonium sulphate* (*1.2 gms per 100 gms of soil*).								
Control	4.0	2.1	16.9	1.4	3.4	4.8	7.8	3.5
2 gm. $Ca Co_3$	9.1	4.6	15.5	1.6	3.7	7.8	6.1	1.7
2 mg. $Mg Co_3$	3.1	0.5	16.7	1.4	3.1	1.8	2.5	1.1
2 gm. $Ca Co_3$ + 2 gm. $Mg Co_3$	3.1	0.8	16.7	1.8	3.0	2.0	2.4	1.1

From these figures it appears that magnesium carbonate was most toxic to nitrification in the soils in which calcium carbonate was most stimulating. This would be evidence of the existence of an optimum lime-magnesia ratio for nitrification were it not for the fact that the application of a mixture of the two carbonates generally produced the same effect as magnesium carbonate alone. The magnesium in Hawaiian soils occurs largely as hydrous silicates and, although considerably in excess of the calcium, it is much less soluble in dilute acids and water. It is therefore probable that the stimulating or toxic effects of applications of magnesium carbonate are not due to the variations in the ratio of lime to magnesia present, but rather to increases in the concentration of the magnesium in solution and to double decompositions causing an excessive alkalinity.

The results also show that soy bean cake meal gave a higher yield of nitrate than either dried blood or ammonium sulphate, notwithstanding the fact that only 165 mgs. of nitrogen was added as soy bean cake meal, while 265 mgs. was added as dried blood and 250 mgs. as ammonium sulphate. This cannot be due to insufficient ammonification or to the toxic effect of excess of ammonia, since in previous experiments it was found that, while vigorous ammonification of dried blood took place in these soils, still greater amounts of ammonia were produced from soy bean cake meal.

The effect of magnesium carbonate appears to depend in some cases on the nature of the nitrogenous material used. It was generally more toxic to the nitrification of dried blood and ammonium sulphate than to that of soy bean cake meal. This is probably accounted for by nitrogen assimilation on the part of soil organisms which are unequally affected by the materials applied.

It is remarkable that magnesium in the form of limestone was found to stimulate nitrification, and in no instance was it toxic either to ammonification or nitrification. This action is probably due to its insoluble nature and to its action being confined largely to the maintenance of neutral conditions in the soil. The inefficiency of calcium carbonate in most of these soils was probably due to the unusually high percentages of iron and aluminium hydrates, which may take the place of carbonate in maintaining neutral conditions in the soil.

578 – **Effect of Certain Organic Soil Constituents on Nitrogen-Fixation by *Azotobacter*.** — REED, H. S., and WILLIAMS, B., in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten. II Abt.*, Vol. 43, No. 1-7. Jena, February 15, 1915.

The effects of various organic compounds on the development of *Azotobacter* have been studied in connection with the theory that the soil contains organic bodies injurious to plant growth which are important factors in modifiying the fertility. *Azotobacter* was chosen to represent the microflora of the soil owing to its recognised importance in maintaining fertility and to the possibility of making accurate analytical measurements of its activity. The compounds chosen were such as are likely to occur in the soil: esculin, vanillin, daphnetin, coumarin, pyrocatechin, heliotropin, arbutin, resorcin, pyrogallol, floroglucin, hydroquinone, salicylic aldehyde, oxalic acid, quinic acid, dihydroxystearic acid, rhamnose, borneol, caffein,

betain, trimethylamine, legumin, alloxan, cinnamic acid, aspartic acid, asparagin, hippuric acid, creatin, xanthin and hypoxanthin, urea, formamide, glycocol, allantoin, guanidin, nicotin, picolin, scatol, piperidin.

The results of the experiments show that the majority of the compounds studied have only a slight influence on the fixation of nitrogen by *Azotobacter*; in many cases a depression was noted, but this was generally due to considerable concentration of the compound in question.

Hydroquinone and salicylic aldehyde showed greater toxicity than any other compounds. Esculin, quinic acid and borneol had a markedly stimulating action on the development of the organism.

The effects of these compounds on *Azotobacter* do not generally agree with the action recorded in the case of higher plants; in concentrations fatal to certain higher plants, many of them show only a slight reduction in the fixation of nitrogen.

Some of the nitrogenous compounds investigated, as nicotin, picolin, guanidin and scatol, showed toxic properties similar to those usually attributed to them, while caffein apparently acted as a stimulant. On the other hand, many nitrogenous compounds recorded as having a beneficial action on higher plants, were found to have a depressing action on nitrogen-fixation by *Azotobacter;* in this case the simpler compounds appeared to have a more energetic action than the more complex ones.

It is suggested that this is not due to toxic properties, but to the fact that the nitrogen of these bodies is used by *Azotobacter* in preference to atmospheric nitrogen. Urea, glycocol, formamide and allantoin gave particularly noteworthy depression of nitrogen-fixation.

579 – **Investigations on Protozoa in Relation to the Factor Limiting Bacterial Activity in Soil.** — GOODEY T. (Protozoologist, Research Laboratory in Agricultural Zoology, University of Birmingham), in *Proceedings of the Royal Society*, Series *B*, Vol. 88, No. 13, pp. 437-456. London, April, 1915.

The soils used in these investigations were 1) one stored since 1846 containing about 3 per cent of water and no protozoa; 2) one stored since 1856 and containing no protozoa; 3) one stored since 1865 and containing both amoebae and flagellates; 4) one stored since 1865 containing about 10 per cent of water and amœbae and flagellates; 5) one stored since 1870 containing about 10 per cent of water and amœbae and flagellates but no ciliates and 6) ordinary fresh soil. Soils 1, 2 and 3 were taken from plots of the same soil the others represent different types of soil.

The following protozoa were used in the inoculation of the soils: *Colpoda cucullus*, *C. steinii*, *C. maupasii*, *Vorticella microstoma*, *Amœbæ* sp. and species of Flagellates. The numbers of protozoa in the soils was first determined by HUTCHINSON'S dilution method, but since it was found to give irregular results an agar plate method was devised and found to be more consistent and trustworthy.

Bacteriological examination of the soils during an incubation period of about 500 days showed that enormous increases in bacterial activity occurred in soils 1, 2 and 3 whether inoculated with protozoa or not, but that he addition of a small quantity of one of the other soils prevented such

increase in bacterial activity. In fact in most cases the addition of a culture of protozoa (with the attendant bacteria) was followed by a bacterial increase greater than that of the untreated soils, and resembling the effects of partial sterilisation.

Similar results were also obtained when fresh soil was partially sterilized by means of toluene and inoculated with protozoa.

A noticeable feature of the bacterial activity of the 1846 soil free from protozoa is the subsequent decrease to a level below that of the remaining samples whether untreated or inoculated with protozoa.

The introduction of large numbers of bacteria into the soil samples along with the added protozoa must be a source of disturbance to the bacterial flora and for this reason these experiments cannot be considered as showing a clear issue between protozoa on the one hand and bacteria on the other. It was hoped to overcome the effects of this disturbance by continuing the experiments over long periods. The precaution was also taken to air-dry all the soils partially after they were inoculated so as to favour excystation of the protozoa during incubation. It is therefore extremely improbable that the protozoa failed to function.

Determinations of the numbers of protozoa in the soils showed that the presence of 10,000 amœbae per gramme of soil is not sufficient to reduce the bacterial content of a soil to the level of a similar soil containing no protozoa even though the soil be kept under conditions favourable to the trophic existence of amœbae and flagellates. Thus, the storage of soils under dry conditions during long periods and the partial sterilisation of soils by toluene or heat removes the factor limiting bacterial activity, but this factor cannot be restored by inoculation with protozoa.

It is therefore concluded that the factor limiting bacterial activity in normal soils and which is capable of being transferred to partially sterilised soils is not of protozoan origin.

580 – **Notes on Some Methods for the Examination of Soil Protozoa.** — MARTIN, C. H. and LEWIN, K. R. (Rothamsted Experimental Station), in *The Journal of Agricultural Science*, Vol. VII, Part I, pp. 106-119 + Plates II-III. Cambridge, March 1915.

The writers point out that considering the heterogeneity of the soil it appears almost impossible to hope for an accurate method of estimating the numbers of active protozoa in the soil. An approximate idea of the relative abundance of active protozoa in soils may be obtained by examination of fresh films. Though this method is only approximate it shows those striking differences in the fauna of different soils which alone can be regarded as significant and which may form a sound basis for general conclusions.

By this method a sample of the soil is placed in a dish and water gradually added until the soil is submerged. In the case of dry clay soils, the soil may be crumbled into a dish of water. Surface films are then taken off by means of coverslips. The method may be modified by passing a stream of air through a suspension of the soil in water and suspending a coverslip over the surface of the water so that the bubbles burst on its sur-

face. In this way there were obtained certain amœbae whose presence could not be detected by other methods.

By using a fixing solution of picric or corrosive alcohol and water preparations of the active fauna may be obtained in fresh fixed films.

For cultures preference is given to solid media : one of which was an ordinary agar, medium made up of 1 000 cc. meat extract and 15 grm. of agar but Friedberger and Reiter's medium containing horse dung was found most useful.

Various types of soil were examined by these methods. In the soil of a cucumber border amœbae of the limax type (*Vahlkampfia soli* n. sp.) and one of the lamellipodian type (*A. cucumis* n. sp.) were predominant. Thecamœbae were the next most numerous and flagellates and ciliated were present only in small numbers. A garden soil from an old manure heap contained many amœbae but had a great preponderance of thecamœban forms. In culture the thecamœbae did not appear in considerable numbers until 2 or 3 weeks after the culture had been started, so that from the cultural results alone it would have been imagined that flagellates, both large and small, and amœbae were the dominant forms. In a moderately poor garden soil no particular species appeared to predominate and though density of the fauna was relatively low, the number of species was greater than in the preceding soils. A black leaf mould from a wood was found to contain abundant thecamœbae and fewer amœbae, flagellates and ciliates. The deposit from a sewage bed contained enormous numbers of phytoflagellates with an abundance of thecamœbae and amœbae. The ciliates and smaller flagellates were fairly well represented.

Thus, it appears that the most important types of soil protozoa are thecamœbae and amœbae, whilst flagellates and ciliates are relatively rare, the most successful being the small monads. This result is not revealed by cultural methods, which appear to favour the larger flagellates.

The dominant protozoa found in a trophic state by the film preparations may also be the dominant form found in cultures, but the result appears to depend upon the water content of the soil and the culture method adopted. The richer the soil and the higher the water content at the time of examination, the greater the probablility of the dominant culture form being the dominant trophic form in the fresh soil.

It is probable that these film methods do not give a fair account of the larger flagellates owing to the mechanical resistance of the soil particles. It is concluded that better methods are required for the detection of the active fauna and a complete study is needed of the possible seasonal variations and of cultural conditions.

581 – **The Bacteria of Frozen Soils.** — Conn, N. Joel (New York Agricultural Experiment Station, Geneva), in *Centralblatt für Bacteriologie. Parasitenkunde und Infektionskrankheiten*, II. Abt., Vol. 42, No. 17-18, pp. 510-519. Jena, 1914.

In a previous paper the writer has shown that the number of bacteria was greater in a frozen soil than in an unfrozen soil. In a frozen or recently thawed loamy soil there were found to be always more than 10 million bacteria per gram and in the majority of cases not less than 15 millions,

whilst only 35 per cent of unfrozen soils contained more than 10 million bacteria per gram. The highest counts of the non-frozen soils were exceeded by more than one third of the counts of frozen soils. During the winter the number of bacteria increases as the soil becomes frozen but tends to diminish on thawing. As a rule the increase and diminution in the number of bacteria is accompanied by corresponding increase and decrease in the humidity of the soil.

The present investigations were carried out to determine: 1) if the increase in the number of bacteria in frozen soils is due simply to the rise of organisms in the ascending soil water from deeper layers; 2) if the development of bacteria in frozen soils is favoured by the lower temperature or greater humidity.

The experiments were made in pots and in the open field. Soil samples were taken to a depth of 15 cm. and thoroughly mixed, 0.5 gm. of the mixture being treated with 100 cc. of sterile distilled water. One c.c. of this suspension was then spread on a gelatine plate and incubated at 17.5 to 18° C. for a week, after which the bacterial counts were made.

The writer summarises his results as follows:

1. The number of bacteria in a frozen soil is generally greater than in a non-frozen soil. This fact was first observed in 1910-1911. A similar result has also been recently obtained in the case of two very different soils (one clay and the other fine sand), also in uncultivated and fallow land as well as in cultivated soils.

2. The increase in the number of bacteria after freezing is not due to the increased humidity of the soil which generally occurs in winter.

3. A similar increase in the number of bacteria occurs in soil in pots, thus excluding the possibility of the movement of bacteria from the subsoil.

4. The cause of this increase of bacteria in the soil and its effect on fertility are not yet known.

MANURES AND MANURING.

582 – **Studies on the Lime Requirements of Certain Soils.** — HUTCHINSON, H. B. and MACLENNAN, K. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VII, Parte I, pp. 75-105 + 1 Plate. Cambridge, March 1915.

In two previous communications it has been shown that caustic lime when applied in sufficient quantity exerts certain effects on the soil analogous to those of partial sterilisation. Calcium carbonate does not exercise this action but since either form of lime may be used to correct the soil reaction, the twofold action of caustic lime requires investigation.

I. *Lime requirements for partial sterilisation purposes.* 100 gr. samples of soil were moistened with 50 cc. of water and shaken up for several hours with quantities of calcium oxide in increasing amounts up to 2 per cent of the soil. They were then washed on a Buchner funnel with 200 cc. of water and the filtrates titrated with $\frac{N}{10}$ acid.

It was found that the quantity of lime required to produce an alkalinity of the filtrate equal to 5-10 cc. of $\frac{N}{10}$ acid gave the best results

with regard to crop growth. Heavier applications increase the bacterial activity, especially that of the ammonifying organisms, but do not give corresponding increases in the crop. The amounts obtained by this method agree very closely with those required for the production of typical partial sterilisation effects, *e. g.* the inhibition of the activity of protozoa and of nitrifying organisms. Certain physical changes in the soil texture, as shown by the rate of filtration, also occur about the partial sterilisation point.

II. *Lime requirements for neutralisation purposes.* Since carbonates and bicarbonates are the chief compounds tending to maintain a neutral reaction in the field, investigations were made with sodium and calcium bicarbonates. Sodium salts were found to give irregular results and were therefore discarded in favour of calcium bicarbonate.

A solution of calcium bicarbonate of approximately $\frac{N}{50}$ strength was prepared in a Sparkelet syphon by means of compressed carbon dioxide. For the determination of the lime requirement, or acidity, 10-20 gms. of the soil were placed in a bottle of 500-1000 cc. capacity with 200-300 cc. of the bicarbonate solution, and the air in the bottle displaced by a current of carbon dioxide. The bottle was then shaken for 3 hours, after which the liquid was filtered and a measured quantity titrated with $\frac{N}{10}$ acid.

Comparative tests of this method with various soils to which various quantities of lime had been added previously, showed proportionate diminution of lime requirements. No absorption was found to occur in the case of neutral soils, thus giving a distinct advantage over several other methods suggested.

Soils showing a positive lime requirement according to this method have been found to respond distinctly to the application of carbonate: *a*) by increased ammonia and nitrate production in laboratory experiments, and *b*) by greater plant growth in pot culture and field work.

The values of calcium oxide and carbonate have been shown to be identical, provided that the lime requirements (for neutralisation purposes) are not fully satisfied, but after the neutral point is reached calcium oxide exercises its specific effect. This fact is of practical importance in view of the opinion generally held in the United States, as to the danger of using caustic lime.

In the case of a very acid soil the returns in plant growth were proportional to the reduction of acidity.

Applications of carbonate exert a marked effect in accelerating ammonification and, to a lesser degree, nitrification.

It follows that the lime requirement test is more important than the determination of the free carbonate in considering the needs of any particular soil. Determinations of the acidity of soils on the same geological formation show a distinct relation between the acidity and the character of the vegetation, but it does not follow that such a correlation exists between different soil formations.

583 – **The Injurious Action of Heavy Dressings of Lime on the Nitrogen Transformations of Moor Soil.** — ARND, TH. (Bacteriological Laboratory of the Bremen Moor Experiment Station), in *Landwirtschaftliche Jahrbücher*, Vol. XLVII, Part. 3, pp. 371-442, 2 figs. Berlin, 1914.

The object of these researches was to determine whether there is any connection between liming and certain injurious transformations of nitrogen, on moor soil. That this should depend upon an injurious effect on the biological activity of the soils in question would seem to be contradicted by the fact that in no case did application of lime decrease the activity of the soil.

With regard to a possible reduction of the soil nitrates to nitrites (1), experiments made with different samples of limed and unlimed peaty soil showed no chemical decomposition of the nitrates. A solution of nitrate inoculated with extracts of heavily limed moor soil gave no chemical reaction that could decompose the nitrate. On the other hand, it would appear that the formation of nitrites from nitrates depends upon temperature, small differences in the latter causing considerable modification in the reduction of the nitrates: this would be a corroboration of the biological nature of the reduction of nitrates in limed moor soils. In any one group of moor soils, the microbiological formation of nitrites due to heavy liming increases with the degree of decomposition of the soil. The soil of fens shows a greater power of producing nitrites than that of upland moors. Such applications of lime as do not remove the acidity of the moor soil bring about no perceptible reduction of the nitrates; but applications that give to the soil a neutral or alkaline reaction induce a formation of nitrites. In the acid soils of high moors, nitrites are rapidly decomposed, owing to a double reaction between the nitrous acid and the peat; in soils neutralised by the application of lime, a chemical decomposition of the nitrites is not observed, the process being brought about solely by micro-organisms.

The first phase, therefore, in the decomposition of nitrates in moor soils is their reduction to nitrites by microbic activity; then the chemical reaction between nitrites and the peaty substances results in the complete breaking up of the nitrous acid; part of the nitrous nitrogen is lost in the soil, and, of the remainder, part is transformed into ammonia or amide compounds, and part is present as organic nitrogen.

The denitrification experiments lead us to conclude that the conditions unfavourable to bacteria obtaining in the soils of unlimed upland moors of acid reaction, hinder the bacterial decomposition of nitrates; in neutralised soil, on the contrary, a rapid breaking up of the nitrates takes place, together with great loss of nitric and total nitrogen. These great losses of nitrogen are in relation to the amount of lime applied. All these facts confirm the theory held by Prof. TACKE (*Protokoll der 72. Sitzung der Zentral-Moor-Kommission*, 42, 1913), that the injurious effect of large doses of lime on the soils of upland moors is to be attributed to the injurious bacterial transformations of the nitrogen.

(1) See *B.* Nov. 1913, No. 1243. (*Ed.*).

584 - ***Tephrosia candida* and *Cassia hirsuta* as Green Manures in Ceylon.** MACMILLAN, H. F. in *The Tropical Agriculturist*, Vol. XLIV, No. 1, pp. 51-52 + 1 Plate. Peradeniya, Ceylon, January 1915.

Of all plants tried as cover crop and for green manuring purposes *Tephrosia candida* has given the best results. It thrives at all elevations up to 5000 feet, and yields, from 3 $^1/_2$ tons of loppings per acre, annually representing about 50 lbs. of nitrogen.

Cassia hirsuta introduced from South America has become naturalised in Ceylon. It is also a quick growing plant and forms an excellent cover.

585 - **New Fertilisers and Waste Materials Studied in the United States.** — HASKINS, H. D., in *Massachusetts Agricultural Experiment Station Bulletin* No. 155, pp. 173-181. Amherst, Mass., 1914.

The percentage composition of some new fertilising materials and waste products is given in the following table.

Percentage composition of certain fertilising materials.

Material.	Moisture.	Potash.	Phosphoric acid.	Total nitrogen.	Soluble nitrogen.	Insoluble assimilable nitrogen.	Insoluble non-assimilable nitrogen.
Sheep manure and wool waste . . .	4.99	2.89	0.31	1.27	0.51	0.30	0.46
Wool waste (grease-free)	44.80	0.37	0.03	1.30	0.27	0.51	0.52
Whale manure (ground)	—	—	9.90	8.16	2.08	3.43	2.65
Seaweed	15.66	1.81	0.23	0.60	0.09	0.15	0.36
Raw kitchen waste	64.89	0.11	0.81	0.78	0.15	0.10	0.53
Sewage (grease-free)	7.30	0.03	1.62	5.26	0.40	2.38	2.48
Cotton waste	6.95	1.56	0.68	1.37	0.24	0.27	0.95
Cocoa shell dust	11.09	2.71	1.49	2.94	1.04	0.51	1.39
Wool-waste (from spinners)	4.95	0.68	0.20	4.40	0.12	2.41	1.87

	Moisture.	Lime.	Magnesia.	Total nitrogen.	Sulphates.	Carbonates.	Insol. matter.
Lime residue from lactic acid factory	46.00	19.23	0.44	030	27.50	0.98	0.68
Lime residue from purification beds	16.87	42.43	1.30	—	—	34.00	—
Lime residues from tanneries. . . .	35.93	24.80	3.10	042	—	4.44	16.37

	—	Potash.	Phosphoric acid.	Available phosphoric acid.	Lime.	—	—
Calcined phosphate	—	0.59	32.06	26.32	36.99	—	—

Sheep manure is recommended for maize at the rate of 4 to 5 tons per acre; this manure, especially when obtained from wool-carding establishments, is very liable to contain weed seeds. *Wool waste* (grease-free) should be applied at the rate of 5 tons per acre for maize and permanent pasture. *Whale manure* contains a relatively high percentage of fat (13.82 per cent), which probably prevents the rapid utilisation of the nitrogen. *Seaweed* (wrack) should be used in combination with lime or better with basic slag, or superphosphates.

Kitchen waste acquires a certain importance, owing to the number of municipal establishments for treating it; when dried and ground it is largely used in compound manures; in the raw state it is worth the cost of local transport. *Calcined phosphate* is obtained from the NEWBERRY-FISHBURNE process (1). With regard to the *sewage waste*, the removal of the grease is not profitable and the raw material is not recommended owing to its slow action. The composition of *cotton waste* varies considerably and it is probably best applied in trenches mixed with farmyard manure. *Cocoa shell dust* is richer in nutritive elements than ground shells and can be applied at the rate of 1 ton per acre with 100 lbs. of chloride of potash and 300 lbs. of basic slag or superphosphate. Of the three *lime residues* examined, the tannery product contains 0.5 per cent of arsenic acid, which would not be injurious if applied at the moderate rate of 2 tons per acre. These lime wastes and also that of acetylene apparatus can be used locally with advantage if obtained gratis or at a low price. It is advisable to apply them in the autumn and winter so as to allow oxidation of injurious substances.

586 – **The Action of Common Salt and Kainit applied with Sulphate of Ammonia and Nitrate of Soda.** — SCHNEIDEWIND in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen*, Year 17, No. 1, pp. 3-5, Halle a. S., 1915.

Considering that the particularly favourable action of nitrate of soda on beets is due partly to the soda, an attempt was made to increase the efficiency of sulphate of ammonia by the addition of sodium chloride. The experiments showed that a mixture of the two salts gave better results than the ammonia alone. Experiments have been made by SCHNEIDEWIND, MEYER and MUNTER to determine the effect of adding sodium chloride to nitrate of soda and comparing with raw kainit containing 50 per cent or more of sodium chloride. The experiments were made during 1911 to 1914 with the following succession of crops: 1) spring wheat; 2) mangels; 3) spring wheat; 4) sugar beets. The various manures were: *a*) 40 per cent potash; *b*) 50 per cent potash + sodium chloride; *c*) kainit; these manures were applied: 1) without nitrogenous manure; 2) with sulphate of ammonia; 3) with nitrate of soda.

The results showed that the accessory salts in kainit had the same action as common salt added to 40 per cent potash salt and, with one exception, the action was the same with sulphate of ammonia as with nitrate of soda.

(1) See *B.* Nov. 1912, No. 1509. (*Ed.*).

587 – **The Antigen Mixture Method for the Examination of Seeds** (1). — ZADE A., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 42, No. 45, pp. 712-718. Jena, January 21, 1915.

By his previous experiments the writer had already shown that the varieties of agricultural plants can very well be distinguished in a serological manner (*Zeitschr. für Pflanzenschutzung*, Vol. 2, 1914, pp. 101 et seq.); but so far, in practice insurmountable difficulties have been encountered, for the number of varieties is too great for it to be possible to obtain a useful serum for each. The number of animals required was too large and the expenses connected with their keeping and feeding, as well as those entailed by inoculation and obtaining the serum, were too great, while the work required was tedious and protracted. The "Antigen Mixture Method" devised by the writer is in this respect an essentially simplifying and time-saving process whereby the practical carrying out of the method is considerably facilitated.

In this method, the seeds of the varieties to be distinguished, about six in number, are mixed together in equal portions by weight and ground. The resulting "flour" is extracted with a physiological solution of common salt, so that in the extract there are the antigens of six different varieties of the same species. The extract thus obtained is used, after filtration, for injections which can be carried out in the most convenient way (subcutaneously, intraperitoneally or intravenously). The serum of the animals that have been subjected to the preliminary treatment, now gives precipitin reactions with the antigens of all the six varieties used for inoculation, but with this important distinction, that the reactions are strongest if the completely homologous extract (in the case in question, the extract of all six varieties) is added. If the extract from one only of the six varieties is used, given the same degree of concentration, the reaction becomes very much weaker, so weak, indeed, that even in the case of relatively slight dilution of the serum it is invisible. It is important that even an almost "completely homologous" antigen, in this case one from only five out of the six varieties used for inoculation, already shows a considerably less intense reaction than a "completely homologous" one. It is easy to dilute the serum to such an extent, that within a certain period of observation only the "completely homologous antigen" forms precipitins.

The proof of the identity of a variety is obtained by the difference determination. For instance, to identify a sample of seed of one of the six varieties mentioned, first a completely homologous extract is obtained, then one from only five out of the six varieties, but without in any way altering the degree of concentration. With the extract from the five varieties, as has been said above, with a certain dilution of the serum no precipitate worth mentioning is any longer obtained. To the extract of the five varieties is added that of the unknown one, without making it more concentrated, and the reaction intensity is awaited. If this does not increase, the unknown variety is not that which was omitted as minus variety in making the extract. The investigation is pursued by taking another variety as "minus variety", again adding the extract from the unknown

variety and continuing in the same manner until the reaction intensity of the extract of the five varieties, plus the extract of the unknown one, exactly equals the reaction intensity of the completely homologous extract. As soon as this occurs, we know that the last added is the unknown variety.

The writer goes on, further, to speak of the results of his experiments with a mixed extract of six varieties of peas and also one of a variety of peas and a variety of wheat, the data being summarised in tables. He also remarks that to obtain a serum it is a question of the mixture of little more than 6 or 8 varieties. If it is required to obtain a serum of many different species or genera, the extracts of a whole number of species or genera can be mixed together, as in the case of the experiments with varieties. The more distant is their relationship, the more groups of forms can be mixed in this way ; consequently this method will find application in questions of systematic botany.

588 – **Magnesium in Albinistic and Chlorotic Plants**. — MANELI, EVA (Botanical Institute of the Royal University of Pavia) in *Atti della Reale Accademia dei Lincei, Rendiconti*, Vol. XXIV, Part 3, pp. 262-267. Rome, February 25, 1915.

In a preceding work, the writer has shown experimentally that the amount of chlorophyll formed in epigean assimilating organs is in connection with the quantity of magnesium given to the plant. When grown in solutions lacking magnesium, plants of diverse affinity (*Protococcus viridis, Spirogyra majuscula, Vaucheria* sp., *Zea Mays, Polygonum fagopyrum, Helianthus annuus, Torrenia fournieri*) produced thalli or leaves completely etiolated or just tinged with green ; grown in solutions containing various amounts of magnesium, they developed thalli or leaves whose intensity of coloration increased with the increase in the amount of magnesium given to them. The ether extracts of these leaves, on being compared by the colorimetric method, showed that there is a constant *direct* connection between chlorophyll and magnesium.

The researches set forth in the present article aim at giving a new contribution to the demonstration of the existence of this connection by means of the quantitative determination of the magnesium contained in the green leaves (or portions of leaves), and in white or pale yellow leaves (or portions of leaves), belonging to the same variegated or chlorotic plant. The chemical analyses hitherto carried out on green leaves, or on the corresponding white or chlorotic leaves, have given contradictory results. This, in the writer's opinion, is principally due to the fact that such analyses sometimes refer to *normally* white leaves, and at others to leaves either etiolated by chlorosis, or turned yellow by the cold of winter; thus they were made with material under conditions that were essentially different physiologically.

The experiments here reported were carried out with variegated forms of *Vinca minor, Pelargonium zonale, Pandanus javanicus, Polygonum orientale, Acer negundo, Spiraea lobata* and *Aegopodium podagraria* and with some chlorotic branches of *Camellia japonica, Rosa bengalensis*, and *Catalpa bignonioides*. All the leaves of each plant were removed and separated into

reen leaves (or portions of leaves) and white leaves; these were analysed eparately.

From the analytic results the following points may be deduced :

1. In two out of three cases of plants affected by chlorosis, the chlo- otic parts contained larger amounts of magnesia. Probably the different ature of the physiological causes capable of giving rise to chlorosis, exer- ises, according to circumstances, different effects upon the absorption of he salts.

2. In albinistic plants, the amount of magnesium was greater in ight cases out of nine in the green than in the respective white parts of he same individual. This result confirms the belief that there exists a lose physiological connection between magnesium and chlorophyll, and upports the observation made by WILLSTÄTTER, that chlorophyll is a ompound containing magnesium.

89 – **The Transpiration Coefficents of Cultivated Plants**. — TOULAIKOFF, N. (Director of the Besentchuk Agricultural Experiment Station) in *Journal Opitnoï Agronomii* (*Journal of Experimental Agriculture*, Vol. XVI, Part. I, pp. 36-76. Petrograd, 1915.

The study of the question of the transpiration coefficients of cultivated lants, *viz.*, of the amount of water necessary to form a unit of dry matter, s part of the chief work of the culture house of the Besentchuk Agricultural Experiment Station, as this is situated in a district of South-East Russia province of Samara) which suffers greatly from prolonged summer drought, nd excessive variations in the crops. The experiments were carried out uring the five years 1910-1914, in the culture house and in the open, n order to answer the following questions: Is it possible to overcome apid changes of temperature and great variations in the amount of umidity in the soil and the air by means of cultivating plants possessing reat properties of resistance? Is it possible to obtain such a combination f anatomical and physiological characters in a cultivated plant as to nsure, in all circumstances, the maintenance of its highest productive apacity? And, finally, in what relation does the latter stand to its envi- onment?

The pot experiments were begun in 1910 in the culture house, which is rotected above by a glass roof and at the sides by wire netting; their umber continued to increase so that by 1914 there were 408 pots. A easured volume of water was given to each pot throughout the growing- eriod, so that the daily or seasonal consumption could be calculated. ow, dividing the total amount of water consumed by the plant by the mount of dry matter of the aerial parts of the same plant, we obtain what s commonly known as the transpiration coefficient. This coefficient, s shown by the experiments, has not a constant value for every plant, but hanges within somewhat wide limits from year to year, according to the eteorological conditions of the surroundings and the humidity of the soil n which the plant is growing. For example, on cultivating plants under lentical conditions of soil humidity (60 per cent relative humidity) and ith the same amount of nutritive substances, the following transpiration oefficients were obtained:

	1911	1912	1913	1914
Wheat var. Polltawka	628.4	444.5	338.6	387.6
» » Bieloturka	756.3	475.9	316 5	397.1
Oats » Giant	655.1	510.3	347.4	369.9
Barley » Moravian	617.9	461.6	230.3	413.3

The year 1911 was excessively dry, while that of 1913, on the contrary, was too rainy; 1912 was an average year and, 1914 rather dry. Comparing the coefficients, it may be said that there is a definite relation between the numerical value of the transpiration coefficient and the humidity of the air.

In order to study the question more thoroughly, experiments were also made with Livingston's evaporimeter and the results obtained showed, according to the writer, that, as regards the question of the amount of water consumed by a plant in different years, or in the different seasons of the same year, the greatest influence is exerted by the external meteorological conditions, and not by the biological character of the plant.

	Bieloturka wheat	Poltawka wheat	Moravian barley	Giant oats	Common millet
Humidity of soil 60 %.					
Amcunt of water evaporated, cc.	18 284	18 206	20 840	22 875	14 025
Yield of dry matter (aerial parts), gms.	44.11	41.55	48.00	48.56	44.51
Yield of grain, gms.	16.02	15.63	20.41	18.99	20.34
Transpiration coefficient	441.4	449.8	439.5	480.5	307.3
Humidity of soil 40 %.					
Amount of water evaporated, cc.	10 841	11 401	14 728	12 706	10 704
Yield of dry matter (aerial parts), gms.	30.99	28.92	35.14	37.20	37.84
Yield of grain, gms	11.34	12.66	13.63	16.27	15.39
Transpiration coefficient	391.0	405.1	434.3	356.4	279.6
Humidity of the soil 20 % (*).					
Amount of water evaporated, cc.	2 881	3 553	3 296	5 096	4 949
Yield of dry matter (aerial parts), gms.	8.50	7.98	8.94	12.28	16.28
Yield of grain, gms.	2.85	3.20	2.60	5.06	5.55
Transpiration coefficient	457.7	426.4	544.2	652.5	367.1

* The averages of these experiments are for three years (1911, 1912 and 1914).

The accompanying table gives the chief results of the experiments, *viz.* he averages for the four years 1911-1914, which refer to the amount of vater transpired, the dry matter produced, the amount of grain obtained, nd to the coefficients of transpiration under the different conditions of oil humidity, *viz.* 60, 40 and 20 per cent of the relative humidity.

Experiments on the transpiration coefficient were also instituted in he open and since the majority agreed with those of the culture house, he writer draws the following conclusions:

1. In studying the conditions of the consumption of soil moisture by different plants in the arid part of the province of Samara, it has been clearly shown that the daily consumption of water on the part of the plant is in ntimate relation with the meteorological conditions of the period of growth, nd, to be precise, in inverse ratio to the humidity of the air. The plants hat have been studied from this point of view (beardless common wheat, earded durum wheat, oats, barley and millet) do not differ in the course f the daily consumption of water, but only in the absolute amount of vater used.

2. The transpiration coefficient is not a constant quantity, but va- ies from year to year within somewhat wide limits in connection with the external meteorological conditions of the locality and the reserves of soil noisture at the plant's disposal.

3. The experiments carried out in the culture house of the Besentchuk Experiment Station have shown that in the optimum conditions of growth from the point of view of the content of nutritive substances and of humi- dity), or approximately in such conditions (where the soil is a little less damp), there is no practical difference between the transpiration coefficients of bearded durum wheat, beardless common wheat and barley, while this coefficient is less for millet and larger for oats.

4. The variations in numerical value of the transpiration coefficient n the case of a given plant (wheat, oats, millet) are not infrequently larger n different years than for different species in the same year.

6. From the attempts to determine the transpiration coefficient in he open, it was found that the said coefficient is twice as large as that de- ermined in the culture house and that its numerical value depends upon meteorological conditions in the same manner as is the case in the experi- ments carried out under shelter.

6. The numerical value of the transpiration coefficient of summer wheat grown in the open, varies very considerably in connection with the date of sowing: early sowing, which under the experimental conditions gives the largest crop, gives the lowest transpiration coefficient, while late sowing greatly increases the coefficient and decreases the crop.

7. The transpiration coefficients of wheat and oats sown in rows are lower than for the same crops broadcasted.

8. According to the experimental data of 1914, the largest crops of summer wheat and oats were always obtained when the amount of water consumed per unit of production was smallest, and viceversa.

590 – **The Relative Transpiration of White Pine Seedlings.** — BURNS, G. P. (University of Vermont), in *The Plant World*, Vol. 18, N. 1, pp. 1-5 Tucson, Arizona, January 1915.

Three years' experiments have been made on the rate of evaporation from black and white atmometers in terms of transpiration from seedlings of *Pinus strobus*.

Three kinds of covers were used foı the seed beds, viz.: one of wire, a second of wire half-covered with laths and a third entirely covered. The amount of transpiration was determined by weighing plants which had been previously potted. The data recorded represent the results of 15 four-hour periods during the first half of August, 1913.

Comparing the plants with the two atmometers it was seen that the relation between the black atmometer and the plants was the closer.

Using the black atmometer as a basis of comparison the ratios of the transpiration to the evaporation in the three beds were as follows:

No shade	0.0633
Half shade	0.0346
Full shade	0.0088

By means of these coefficients the approximate amounts of water transpired from each tree during the season were calculated as follows:

No shade	21 x cc.
Half shade	8 x cc.
Full shade	x cc.

The composition of these trees was as follows:

	Green weight	Dry weight	Ash	Nitrogen of dry matter
	grams	grams	%	%
No shade	0.304 (1)	0.063	8.29	2.18
Half shade	0.166 (1)	0.034	9.35	2.70
Full shade	0.090 (2)	0.010	10.20	6.89

(1) Average of 500 seedlings.
(2) Average of 1000 seedlings.

These figures show that there was a difference in the material taken from the soil by the three plants.

The plants in the unshaded beds, which transpired the most water, contained the smallest percentage of ash, and the plants which transpired only $^{1}/_{20}{}^{th}$ as much water contained the largest percentage of ash. Considering the total amounts of ash absorbed, these is no very evident relation between the amount of water absorbed and the amount of ash taken up;

twenty times the water is accompanied by only five times the ash and eight times the water by three times the ash.

Plants are therefore not only able to select the minerals they take from the soil, but also to control the degree of concentration of the solution entering the root hairs.

These data indicate that the explanation of the differences in size and chemical composition due to differences in illumination must be sought along the line of photosynthesis and assimilation rather than along the line of absorption and transpiration.

591 – **Oil Content of Seeds as Affected by the Nutrition of the Plant.** — GARNER, W. W. (Physiologist), ALLARD, H. A. (Assistant Physiologist), FOUBERT, C. L. (Scientific Assistant, Tobacco and Plant-Nutrition Investigations, Bureau of Plant Industry) in *Journal of Agricultural Ressearch*, Vol. III, No. 3, pp. 227-249. Washington, D. C. December, 1914.

Up to the present no extensive investigations of the oil content of seeds as affected by the various factors of nutrition have been reported. In selecting the plants for this work the commercial importance of the seeds and their suitability for the work was taken into account. The following seeds were therefore chosen: cotton, soy-bean and pea-nut (*Arachis hypogœa*).

In analysing the seed the official method for the determination of the oil was followed, using anhydrous ether as the solvent. In the case of soy beans there is a fairly uniform increase in oil content, both relative and absolute, throughout the development of the seed, except during the period immediately following blooming and that directly preceding final maturity, and there is no evidence of a critical period of very intense oil formation at any stage of seed development. The tests with cotton also show a gradual increase in percentage of oil. A change in the normal distribution of the vegetative and reproductive parts of the plant by partial defoliation (50 to 60 per cent) caused a decided reduction in the yield of beans, but the size of the beans and their oil content were only slightly affected, except in the case of an early-maturing variety. On the other hand, the removal of a portion of the blossoms or young pods caused a notable increase in the size of the beans remaining, but did not materially affect the percentage oil content. No correlation was found between size of seed and the percentage content of oil. These characters appear to be affected more by the character of the growing period than by its duration.

The different varieties of soy beans grown under the same conditions show marked differences in oil content and size of seed, and when grown under a very wide range of conditions these differences become much greater. The different varieties are not affected alike by changes in environment. The difference in oil content of cotton seed grown in the Coastal Plain and the Piedmont regions of the south was greater than the varietal differences when grown in the same environment.

Various tests carried out with cotton, soy-beans, pea-nuts and sunflower in various types of soils show that the relative effects of different

soil types are not specific and constant, but depend largely on seasonal conditions.

From these experiments it is concluded that under practical conditions, climate is a more important factor than soil type in controlling the size of the seed and its oil content. In manurial experiments the addition of a complete fertiliser to an unproductive soil increased the oil content of cotton seed, whilst applications of nitrogen lowered the percentage of oil and applications of phosphorus or potassium had no effect on the oil content.

592 - **Effect of Röntgen Ray Treatment of the Seeds upon the Development of Plants of *Vicia faba*** (1). — PFEIFFER, TH., and SIMMERMACHER, W., in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXVI, Part 1-2, pp. 35-43. Berlin, 1915.

The results hitherto obtained with regard to the action of Röntgen rays on plants are very discordant. The writers therefore thought it would be well to repeat the experiments already made, taking account of the possible disturbing influences that might conceal the action of these rays. In order to study such a disturbing influence exercised by light, they kept some of their cultures in the open, some in a room lighted by a north window and others in the dark. Every experiment was carried out at the same time in two pots, in each of which were placed eight bean seeds, but afterwards only five seedlings were left — those that were most uniform.

The seeds either received no treatment, or were subjected to the action of Röntgen rays for 30, 60, 90, 120 or 150 seconds. As regards rapidity of germination, a certain increase was noted with seeds exposed to Röntgen rays for an average length of time (60 or 90 seconds) and a decrease with those exposed for a longer time (120 and 150 seconds). The pots contained sand from the Oder and were given a complete manure. The seeds were sown on May 26, and the plants were collected on June 25.

There were no marked differences in either height or dry weight between treated and untreated plants either in the open or in the dark; the only difference observed was a slight gain in weight of the plants from the seeds exposed to the Röntgen rays grown in the room with north light.

593 - **The Effect of Strongly Calcareous Soils on the Growth and Ash Composition of Certain Plants**. — GILE, P. L. (Chemist), and AGETON C. N. (Assistant Chemist). — *Porto Rico Agricultural Experiment Station, Bulletin*, No. 16, 45 pp., IV plates. Washington, D. C., September 17, 1914.

Excess or deficiency of lime appears to be the cause of many soil troubles in Porto Rico, and since a considerable portion of the arable land of Porto Rico is sufficiently calcareous to produce nutritional disturbances in various crops grown on it, it was deemed important to study the effect of varying amounts of carbonate of lime in the soil on the growth and composition of plants.

For this purpose four plots 10 by 20 ft. were dug out in clay soil to a depth of 2 feet and filled in with mixtures of clay, sand and disintegrated

(1) See also *B.* Nov. 1914, Nos. 989 and 990. (*Ed.*).

limestone (from coralline rock) in such proportions as to furnish soils of approximately equal texture and with carbonate of lime contents of 0, 5, 18 and 35 per cent. The resulting soils were of good loamy texture, but very low in organic matter, and after each crop the roots were removed so as to avoid accumulation of humus, which previous work had shown to have a modifying influence on the action of carbonate of lime. Complete manure was applied in sufficient quantities, and water was given when the rainfall was insufficient.

The plants grown were : rice, soy beans, bush beans (*Phaseolus nanus*) radishes, sunflowers, sweet cassava (*Manihot palmata*), sugarcane and pine-apples. Six different crops of each were grown during the three years of the experiment ; for analysis the crops were cut before complete maturity (soy beans and bush beans in flower, radishes at marketable size, etc.) and as far as possible at the same stage on the different plots ; withered leaves were discarded.

The writer's summary of the results is as follows :

" The growths of bush beans and radishes were unaffected by even 35 per cent of $CaCO_3$. The growths of sunflowers, soy beans and sugarcane were somewhat depressed by 18 per cent of $CaCO_3$; the growth of sweet cassava was somewhat depressed by 5 per cent of $CaCO_3$ and markedly by 35 per cent of $CaCO_3$; the growths of rice and pine-apples were markedly depressed, with the appearance of chlorosis, by 5,18 and 35 per cent of $CaCO_3$.

" The carbonate of lime apparently had no effect on the amount in nitrogen, potash and phosphoric acid contained in the various plants, but did increase slightly the total carbon-free ash in all the plants except rice, and modified the amount of either lime, magnesia or iron in the ash of all the plants.

" On the calcareous soils the lime in the ash of bush beans was not increased, but there was a slight increase in the amount of lime in the ash of soy beans, sunflowers and sugarcane. On the plot with 5 per cent of carbonate of lime, the lime in the ash of radishes was increased about 17 per cent, but on the plots with 18 and 35 per cent of carbonate of lime the increases of lime in the ash of this plot were progressively less. On the plot with 35 per cent of carbonate of lime, the amount of lime in the ash and dry substance of sweet cassava was markedly increased. On all the calcareous soils the amount of lime in the ash and dry substance of rice and pineapples was greatly increased.

" Some plants whose growth was litte affected by the carbonate of lime bush beans, soy beans, radishes and sunflowers) showed marked decreases n the amount of iron or noticeable decreases in the amount of magnesia n the ash, when grown on the calcareous soils.

" The plants whose growths were most depressed on the calcareous soils rice and pineapples) showed the greatest increases in the amount of lime n the ash and dry substance of the plant, and also a marked decrease in he amount of iron in the ash.

" If the plants which have made the best growth have an ash composition nearest the optimum, it would appear from these results as though the diminished growth of the plants most affected on the calcareous soils were due to either 1) an undue increase in the lime content of the plant or plant ash, or 2) an increase in the lime combined with a decrease in the iron in the plant.

" From these results alone it would appear as though the first supposition were correct, but from direct experiments with pineapples the second supposition appears more probable ".

594 - **Experiments on the Effects of Potassium Ferro-cyanide on the Growth of Plants.** — HASELHOFF, E. (Harleshausen Agric. Expt. Station, Kr. Cassel) in *Landwirtschaftliche Jahrbücher*, Vol. XLVII, Part 3, pp. 338-344. Berlin, 1914.

Experiments have been carried out in pot cultures and water cultures to determine the effects exercised by potassium ferro-cyanide, with a view to its use for tempering iron stakes and possibly as a fertiliser for crops.

Pot experiments with French beans in loam soil showed an unfavourable effect upon the crop, due probably to the initial hindrance of the development of the plants ; in sandy soil, a bad effect appears only to be exerted upon the amount of straw. The beans grown in water cultures, showed that the injurious action of potassium ferrocyanide begins at a content between 0.1 — 0.5 gm. per litre of nutritive solution, and is already intense with a content of 0.5 gm.

PLANT BREEDING.

595 - **Methods followed in the Division for the Selection of Agricultural Plants of the Trent Provincial Council of Agriculture.** — CATONI, GIULIO, reprint from *Atti dell'I. R. Accademia Roveretana degli Agiati*, Acad. Year CLXIV, Series IV, Vol. IV, 8 pp. Rovereto, 1914.

The selection of agricultural plants in the Trentino was begun in 1908 at the initiative of the Provincial Council of Agriculture of Trent, which enlisted Prof. EDOARDO BASSI for this purpose.

Hitherto, selection has been applied to wheat, oats, clover and lucerne, while the selection of potatoes and grasses has been commenced. The characters aimed at are : productivity with resistance to diseases and to lodging, and, in the second place, relatively early development. The system adopted consisted in first selecting parent individuals of each species ; these were taken from the ordinary crops growing in the country and consisting of varieties already acclimatised in the district and originally imported from places noted for the varieties cultivated there. The wheats are Gentile Rosso and Cologna ; the oats are Wirsche and Potato ; common varieties of lucerne and clover from Romagna and Upper Italy are used. The seeds of each of these individuals of first selection are entrusted to a single plot, according to Nillsson's usual method. In the case of each plot are registered the observations made during the period of growth and those relating to yield. The 10 or 12 descendants that seem the best as regards yield, behaviour and characters are reproduced next year, each in a separate plot, and subjected to the same comparative examination. Those are rejected that show a tendency to lodging, or are susceptible to rust

and straw blight, as well as such as are unproductive or late in ripening. These 10 varieties are kept under observation for at least five consecutive years, and in the last year the two or three best families, showing the greatest fixity in character transmission are chosen; these families are tested on a larger scale in ordinary fields.

The two or three best families having thus been isolated, their propagation and the preservation of their characters is provided for by planting them in *reproduction fields*. These are sown every year with seed originally coming from the isolated line. Theoretically it should produce individuals that are all alike and have fixed characters, but practically it has been found (and these observations have been corroborated by other similar ones made by Prof. TODARO) that the isolated line, although transmitting the external characters unaltered, always requires subsequent selection in order to preserve a high coefficient of productiveness. The new families are therefore subjected to mass selection, which is carried out every year in fields cultivated for the purpose. It consists in selecting the best ears of the most vigorous plants, sowing the seed in a separate plot and cultivating the crop with special care in order to obtain sufficient seed the following year to sow an area large enough to ensure the requisite supply for distribution among the farmers of the region.

596 - **Brachysm, a Hereditary Deformity of Cotton and other Plants.** — COOK, O. F., in *Journal of Agricultural Research*, Vol. III, No. 5, pp. 387-399, 10 plates. Washington, D. C., February 1915.

The writer proposes the name "brachysm" for the abnormal variations of plants characterised by contraction of the internodes, without corresponding reduction in the other parts of the plant. When the reduction affects the plant in a large number of parts or in all its parts, a dwarf is produced. Although dwarf plants have no great agricultural importance, several varieties showing "brachysm" are much appreciated (*e.g.* certain garden crops, the varieties of cotton known as "cluster" and "limbless", the San Ramon Coffee of Costa Rica).

Brachysm indicates a degeneration which in several different families of plants has occurred as a mutation and is therefore a transmissible character.

The contraction of the internodes of the cotton plant is limited generally to the flowering branches and does not extend to the main stem or vegetative branches. Brachytic variations occur independently in different species and varieties of cotton, and do not constitute a natural group with a common origin. They are of frequent occurrence and have been met with in so large a number of species and varieties of cotton that it cannot be concluded that brachysm is the result of a former cross with a contracted ancestral type. Supposing that the variations of brachysm represent the formation of a new character according to De Vrie's mutation theory, it is difficult to explain why the same character appears suddenly in so numerous and so widely different types of plants. But if brachysm is considered as a fault or insufficience of normal heredity, it is easier to understand that the different species may be subject to similar disturbances.

Special conditions of environment, such as drought, may also produce a false brachysm which is not transmissible. Brachysm in cotton is generally accompanied by other anomalies in the internodes, leaves and bracts of the involucre. There is also a greater tendency to abortion of the floral buds, the aborted or dead buds often remaining attached to the plant because of the absence of a well differentiated abscis-layer at the base of the peduncle. The fact that the shortening of the internodes is so often accompanied by abnormal leaves and involucres suggested to the writer the hypothesis that brachysm represents a reduction of the normal specialisation of the different parts. Although the variations which give rise to brachysm originate in changes in the manner in which the characters appear and are transmitted, they furnish no new proof of the general theories of mutation and Mendelism in the explanation of evolution. These variations represent a reduction in specialisation or an incomplete expression of characters. They are therefore cases of degeneration and they should not be considered as examples of normal inheritance or of evolution of new characters. The abnormalities of brachytic variations are analogous to those of hybrids and are also accompanied by a tendency to sterility or abortion of the buds.

Brachysm is bound up with other forms of intermediate expression of characters and represents with them a general class of "metaphanic" variations.

The economic value of varieties of cotton showing brachysm is diminished by their tendency to abnormal variations and sterility, and also by the fact that they are more severely affected by unfavourable conditions. Brachysm should therefore be avoided in the selection of superior varieties of cotton.

AGRICULTURAL SEEDS

597 – **The Quality of Farm Seeds sold in New South Wales.** — CARNE, W. M. in *The Agricultural Gazette of New South Wales*, Vol. XXVI, Part. 2, pp. 138-142. Sydney February 1915.

During the past year 104 samples of farm seeds, which may be considered typical of the seed sold in this State, were examined.

Evidence of impurity of variety was detected in many samples of maize, and also in vetches and cowpeas.

In general the purity of the samples was fairly good. As might be expected, the excessive presence of weed seeds was mainly confined to grasses, clovers and lucerne. As instances of the dangers of impure seed it may be mentioned that sowing rye grass according to sample 32 (see accompanying table) at the rate of 40 lb per acre would mean sowing 800 000 weed seeds to the acre. Lucerne (sample No. 38) at the rate of 12 lb. would mean 30 000 weed seeds to the acre.

With the exception of nine samples of seeds, 60 per cent of the samples were found to be under standard. It must be remembered that the results obtained in germination tests are higher than those obtained under the usual conditions of sowing. Further, low germination results are usually accompained by lack of vigour in the seedlings which do grow.

The difference between two samples of high and low germination is greater than is indicated by the test results.

Results of Tests of Farm Seeds on Sale in New South Wales 1914.

No.	Name	Pure Seed per cent	Inert matter per cent	Weed seeds per cent	Germination per cent	Approximate numbers of weed seeds to 1 lb. of sample
1	Saltbush (*A. triplex halimoides*)	100	—	—	14	—
2	» (*A. semibaccata*)	90	10	—	52	—
3	» (*A, vesicaria*)	100	—	—	18	—
4	Oats	99.75	0.02	0.23	79	108
5	»	93	0.5	6.5	97	1 995
6	»	99	0.25	0.75	95	299
7	»	99	0.5	0.5	98	453
8	»	98.6	0.4	1	97	217
9	»	99.5	0.5	—	95	15
10	Rape	100	—	—	93	—
11	»	100	—	—	99	—
12	»	99.4	0.1	0.5	56	724
13	Swede turnips	99	0.5	0.5	75	195
14	Turnips	98	2	—	27	—
15	Hungarian Brome grass	97	2	1	—	105
16	Prairie grass	99	0.75	0.25	—	270
17	Rhodes grass	92	7.5	0.5	47	907
18	»	95	5	—	13	—
19	»	100	—	—	5	—
20	»	100	—	—	16	—
21	Pumpkin	100	—	—	44	—
22	»	100	—	—	52	—
23	»	100	—	—	84	—
24	Cocksfoot	99.9	—	0.1	43	440
25	Wallaby grass	100	—	—	51	—
26	Teff grass	99.9	—	0.1	92	2 720
27	Buckwheat	99.7	0.1	0.2	94	196
28	Skinless barley	99.5	0.25	0.25	90	51
29	Cape barley	99.5	0.5	—	97	—
30	Japanese clover	100	—	—	—	—
31	» »	56	19	25	36	154 000
32	Perennial rye grass	93.2	0.8	6	79	19 710
33	» »	98	—	2	56	3 990
34	Italian rye grass	95	—	5	43	13 452
35	Lucerne	99.25	0.5	0.25	54	1 132

Results of Tests of Farm Seeds on Sale in New South Wales 1914.

No.	Name	Pure Seed per cent	Inert matter per cent	Weed seeds per cent	Germination per cent	Approximate numbers of weed seeds to 1 lb. of sample
36	Lucerne	98.7	0.3	1	76	906
37	»	99.3	0.2	0.5	78	1 589
38	»	99	—	1	72	2 567
39	»	97.4	1.6	1	74	2 290
40	»	96.5	3.5	—	93	363
41	»	99.6	0.2	0.2	75	453
42	Black medick	98.6	0.4	1	48	1 582
43	Bokhara clover	99	0.5	0.5	59	680
44	Japanese millet	89	11	—	90	—
45	*Paspalum dilatatum*	96.7	3	0.3	49	302
46	» »	96	1	3	37	5 500
47	» »	100	—	—	—	—
48	French mullet	94.4	0.6	5	72	680
49	Canary grass	98	1	1	28	5 653
50	Beans, Canadian Wonder	100	—	—	96	—
51	» »	100	—	—	98	—
52	» »	100	—	—	60	—
53	» »	100	—	—	96	—
54	» »	100	—	—	90	—
55	» »	100	—	—	100	—
56	» stringless	100	—	—	80	—
57	Field peas	100	—	—	99	—
58	» »	100	—	—	100	—
59	» »	98.9	0.4	0.7	99	108
60	» »	100	—	—	98	—
61	» »	98.7	0.1	1.2	100	57
62	Peas, Yorkshire Hero	100	—	—	88	—
63	» »	100	—	—	92	—
64	» »	100	—	—	96	—
65	» »	100	—	—	92	—
66	» »	100	—	—	74	—
67	» »	100	—	—	84	—
68	» »	100	—	—	88	—
69	» »	100	—	—	72	—
70	Planter's Friend (*Sorghum vulgare*)	99	—	—	40	—

Results of Tests of Farm Seeds on Sale in New South Wales 1914.

No.	Name	Pure Seed per cent	Inert matter per cent	Weed seeds per cent	germination per cent	Approximate numbers of weed seeds to 1 lb of sample
71	Planter's Friend (*Sorghum vulgare*)	100	—	—	90	—
72	» » » »	100	—	—	81	—
73	Early Amber Cane » »	99	1	—	64	—
74	» » » »	100	—	—	73	—
75	Imphee » »	100	—	—	67	—
76	» » »	99.5	0.5	—	75	—
77	Broom millet » »	99.5	0.5	—	80	—
78	» » » »	98	2	—	86	—
79	Alsike clover	97.5	0.5	2	83	11 568
80	Red clover	99.9	—	0.1	90	91
81	» »	94.4	2.6	3	77	12 518
82	White clover	95	—	5	79	27 658
83	» »	97.5	—	2.5	90	13 393
84	» »	91	0.5	8.5	77	30 838
85	Broad bean	100	—	—	90	—
86	» »	100	—	—	100	—
87	Vetch	99.2	0.2	0.6	100	40
88	»	100	—	—	98	—
89	»	75.5	—	24.5	100	1 500
90	Cowpea.	99	1	—	94	—
91	»	97	3	—	86	—
92	»	100	—	—	96	—
93	Maize, Hickory King	100	—	—	86	—
94	» Iowa Silvermine.	100	—	—	80	—
95	» Clarence Champion . . .	100	—	—	90	—
96	» Red Hogan	100	—	—	76	—
97	» » »	100	—	—	96	—
98	» Early Dent	100	—	—	88	—
99	» Yellow Dent	100	—	—	82	—
100	» » «	100	—	—	96	—
101	» Leaming	100	—	—	92	—
102	» »	100	—	—	87	—
103	» Clarence Wonder	100	—	—	91	—
104	» Golden Beauty	100	—	—	90	—

The following samples were found worthless for seeding :

No germination. — *Paspalum* (sample No. 47); Hungarian Brome grass (No. 15) ; Prairie grass (No. 16) ; Japanese clover (No. 30).

Very poor germination. — Rape (No. 12) ; turnip (No. 14); Rhodes grass (No. 19) ; pumpkins (Nos 21 and 22) ; lucerne (No. 35) ; Canary grass (No. 49) ; Canadian Wonder beans (No. 52) ; Yorkshire Hero peas (Nos. 66 and 69); sorghum (Nos. 70, 73, 75).

Ergots (*sclerotia*) were found in Hungarian Brome grass (No. 15) and Perennial Rye grass (Nos. 32 and 33). It is not advisable to sow seed containing this fungus.

Sorghum smut was found in a locally grown sample on sale in Tamworth. This disease had not previously been reported for this State.

Moulds were most noticeable in sorghum and cowpeas.

Insects injurious to seed were found in lucerne seed (two samples), in field peas (one sample), in maize, sorghum and barley (twelve samples). Of ten samples of maize from the North coast nine were affected by weevils. The germination of weevily seed was tested separately from the sound seed. From 2 to 20 per cent of the seeds were affected, and the resultant loss of germination varied from 1 to 8 per cent.

Impurities detected in seed samples: Rib grass (10 samples), Sheep's Sorrel (10 samples), Mustards (7), Black medick (7), *Paspalum dilatatum* Black oats (5), *Bromus racemosus* (5), Docks (5), Cats-ears (4), Millet (4), Chickweed (4), Tarvine (3), Rat-tail grass (3), Smart weeds (3), Timothy grass (3), Catchfly (3), Alsike clover (3), Pigweeds (2), Creeping saltbush (2), Fathen (2) Rhodes grass (2), Cranesbill (2), Perennial rye grass (2), Darnel (2), Summer grass (2), Wire or knot weed (2), Canary grass (2), Selfheal (2), Pigeon grass (2), Suckling clover (2), Wild vetch (2), Charlock (1), Chickweed (1), Yorkshire fog (1), Field cress (1), Corn gromwell (1), Wild flax (1), Italian rye grass (1), Trefoil or burr clover (1), Ditch millet (1), Ox tongue (1), Spurrey (1), Field madder (1), Wild sage (1), Johnson grass (1), Red clover (1).

CEREAL AND PULSE CROPS

598 – **Standard Varieties of Wheat in Western Australia** (1). — SULTON G. L. (Agricultural Commissioner for the Wheat Belt) in *Department of Agriculture and Industries of Western Australia, Annual Report for the Financial Year ended 30th June 1914*, p. 9. Perth, W. A., 1915.

The farmers of Western Australia grow a large number of varieties of wheat. This is an economic waste, as the larger the number of varieties in any given district, the less chance is there of the most suitable ones being used, with the inevitable result that the average yield of the district is reduced. To remedy this state of affairs, the following list of varieties most in favour in Western Australia has been prepared : 1) Alpha, known also as Crossbred 67 and Early Goldsmith ; 2) Baroota Wonder ; 3) Berthoud, also called Scotch Wonder ; 4) Bunyip ; 5) Comeback ; 6) Federation ; 7) Gluyas Early, also known as Wilkinson's Early Prolific ; 8) Lotts, also known as Penny's Square Head, Darts Imperial, Bluey, Chant's Prolific,

(1) See also *B.* April 1915, No. 372. (*Ed.*).

ultor's Prolific, Berrigan Champion; 8) Newman's Early; 10) Queen's ubilee; 11) Yandilla King; 12) Steinwedel, also known as Sullivan's rolific and in Western Australia as Purple Straw.

It is not intended that this list shall remain unchanged. It may be add- d to or amended, but before any other variety can be recognised as a standard" variety it will require to have proved itself of at least equal ıerit for some particular district to those in the list. When a new variety roves superior to a "standard" variety, it will replace it in the list, so that ıe number of "standard" varieties will not become unnecessarily large.

99 – **Group Classification and Varietal Description of some American Potatoes.** — STUART, WILLIAM, in *U. S. Department of Agriculture, Bulletin No.* 176, *Contribution from the Bureau of Plant Industry*, 56 pp., XIX plates. Washington, D. C., March 27, 1915. STARCH CROPS

After having pointed out the difficulty at present existing in the reco- nition of varieties of potatoes by determining the family or group to which ıey belong and the principal methods of classifying varieties of potatoes itherto proposed, and especially those of VILMORIN and KOHLER, the riter explains the system he himself suggests and gives the key to it. ach group is described, with a list of the varieties it includes; and finally, n alphabetical list is given of over 260 varieties, with the origin, descrip- ıon, bibliography, etc., of each. Eleven groups are proposed.

00 – **Trials of Rhodes Grass *(Chloris gayana)* at the Royal Botanical and Colonial Garden at Palermo** (1). — TROPEA, C., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. I, Part 2, pp. 174-176. Palermo, 1915. FORAGE CROPS

Towards the end of April 1910, *Chloris gayana* was sown in sandy, oam soil at the Royal Botanical and Colonial Garden at Palermo, in order o test its value as a drought-resistant forage plant. Up to the present, has stood all the summers well, giving as much as four cuts a year, and eaching 5 ft. in height. The seeds do not ripen in Sicily, so that it is easily xtirpated and there is little fear of its invading other crops. The lack of eeds is no hindrance to its cultivation, for the plant is easily propagated by ıoots. All classes of stock take it readily. The writer considers that Rhodes grass will solve the serious problem of obtaining summer forage in icily.

02 – **Analyses of Agricultural Yield. Part I. — The Spacing Experiment with Egyptian Cotton, 1912.** — BALLS, W. L. and HOLTON, F. S. in *Philosophical Transactions of the Royal Society of London*, Series B. Vol. 206, pp. 103-180. London 1915. FIBRE CROPS

These investigations concern the statistical analysis of the yield of the otton plant in terms of the stages of the plant's development, with a view o determining the effects of environmental conditions on the develop- ıent of the crop. They have also a secondary object, *viz*: to appreciate he reasons underlying the conventional practices of agriculture and pos- ibly to improve these practices.

This particular paper deals with the effects of spacing on the yield of Egyptian cotton at Giza. The cotton crop is peculiarly suitable for this

(1) See *B.* April 1911, No. 1150. (*Ed.*).

investigation since the yield is built up in an obvious way from the flowers of the successive lateral branches.

The method of analysis consists in the making of daily records of the behaviour of an average plant in sample plots and plotting these records as curves. Thus, the growth curve shows the growth in millimetres per plant per day. It was found that the growth of the main stem and of the flowering branches are closely correlated during the early part of the season, so that the growth curve can be used as an index of the rate at which the structure of the flowering branches is being formed. The flowering curve represents the number of flowers opening each day, which is determined by the number of flowering branches formed acropetally along the main stem, the extent to which lateral monopodia behave in similar fashion and the number of flowers which each flowering branch produces. The bolling curve expresses the rate of production of ripe fruits, or bolling, per plant per day. Owing to the shedding of flower buds due to sudden environmental changes this curve has less amplitude than the flowering curve. By multiplying the bolling rate by the number of plants per unit area the yield curve is obtained.

The spacings of the plants in this experiment are given in the following table :

No.	Distances between		Thousands of holes per acre.	Area available per hole.	Angle subtended by two nearest plants on next ridge.
	sown ridges	holes on ridge.			
	inches	inches		square feit	
1	29.5	11.8	18	2.48	20
2	—	17.7	12	3.66	30
3	—	23.6	9	4.95	40
4	—	35.4	6	7.32	60
5	—	47.2	4	9.47	90
6	59.0	11.8	9	4.95	10
7	—	23.6	4	9.47	20
8	—	35.4	3	14.64	30
9	—	53.2	2	21.52	45
10	—	70.8	1 ½	29.60	60

Two acres of land were divided into 50 plots and the planting was accurately carried out so that every plant was within an inch of its correct place. All the spacings were duplicated in two series, one series consisting of plants standing singly and the other of two plants together in one hole as practised by the native cultivator.

It was found that the weight of lint per boll is not appreciably affected by any alteration of spacing so that the final yield is expressed with fair

accuracy by a simple count of the number of bolls ripening and also by the number of flowers opening.

Within the range of experimental error the early flower production was the same for all the spacings. There was therefore no root interference during the differentiation of the first flower buds. The curve for the rate of flowering continues to rise longer with the wider spacings, showing that root interference begins earlier with the narrow spacings. In the widest spacing the rate of flowering is not curtailed until the rise of the water table comes into operation. Comparing the two series the flowering curves of the wider spacings have the same form but the amplitude of the curve for the single plants is twice that of the curve for the plants in pairs. This is accounted for by the daily shortage in soil water for the two interlacing root systems, this daily interference acting as a continuous factor. The height of the main stem was the same in all spacings throughout the season, so that the flower production of all the main stems was initially the same, but in the closest spacings practically no lateral monopodia were developed whereas in wide spacings the plants branched extensively.

Sudden changes in temperature or dryness of the atmosphere may also curtail the rate of flowering, this effect being much more pronounced in the close spacings unless counteracted by attention to the soil water content. Hence, the closer the plants are sown the more skillful must be the cultivation, until further skill becomes impossible of application in actual practice.

The greatest total yield was obtained from spacing no. 2 in the second series (*i.e.* planted in pairs), which is the conventional arrangement practised by the Fellaheen. Close planting is more favourable to the control of the insect pests attacking the late bolls than the use of quick maturing varieties. The only improvement which can be suggested to the native cultivator is a more symmetrical distribution of the plants.

602 – **Some Considerations affecting the Growing of Linseed as a Farm Crop in England : I. Variations in the Oil Content.** — EYRE, J. V. and FISHER E. A. (South Eastern Agricultural College, Kent), in *The Journal of Agricultural Science*, Vol. VIII, Part. 1, pp. 120-134 + 2 fig. Cambridge, March, 1915.

CROPS YIELDING OILS, DYES AND TANNINS

Several varieties of flax have been grown at various centres throughout England during the seasons 1911-1914, and the crop analysed with a view to determining the variations in oil content of the seed at different stages of maturity and with size of seed, and also to determine the amount of degeneration of the seed with successive generations grown in the same locality and the effect of artificial manures.

It was found that the optimum oil formation occurs exactly in the middle of the period between flowering and final ripening and that during the last two or three weeks the increase in oil content was found to be extremely small, thus confirming IVANOFF's results. Therefore little is gained by allowing the seed to ripen before harvesting the crop, and the crop may be grown for the two purposes of obtaining oil and fibre at the same time without any disadvantage to the yield of either product.

Comparison of the results obtained in other countries with those

obtained in England do not support the opinion that English grown linseed is inferior in oil content to foreign seed. The highest yield of oil per acre was obtained in Plate seed (Argentine).

The analyses of seeds of different sizes show a slight increase in the oil content of the larger seeds in any one variety, but the varietal differences are so great as to mask this relation in the case of commercial samples of seed. With regard to the oil content of successive generations of seed it was found that in some instances a diminution in oil content does occur from one generation to another, but the percentage of oil eventually becomes more or less constant. This difference in oil content becomes still less when the various generations are grown side by side under identical condition.

Artificial manures were found to cause only a very slight variation in the oil content and in no case was the difference more than 1.6 per cent. The main effect of manuring was seen in the yields of both seed and straw.

603 – **Trials of Russian Sunflower at the Royal Colonial Garden at Palermo.** — TROPEA, C., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. I, Part 2, pp. 1691-171. Palermo, 1915.

Russian sunflowers were sown in March, 20 inches apart each way, on a sandy loam without manure or irrigation, ploughed and hoed twice. The crop was gathered in September, when the plants were 7 ft. high and the heads 8 to 12 inches across. The yield of seeds was equivalent to 43 cwt. per acre, *viz.*, almost 5 oz. per plant. The seeds yielded 18 per cent of oil; their price may be taken at 7*s* per cwt. The ash from the dried heads and stems amounted to 17 ½ cwt. per acre.

Some plants grown beside an irrigation canal developed much more vigorously than the others, and formed heads mostly more than 16 inches across. It would therefore be very advantageous to irrigate this crop at least once.

Another small trial made at Sciacca (Province of Girgenti) in dry soil in 1914, gave good results in spite of the exceptional heat and drought.

604 – **The Selection of Coconuts for Germination.** — *Bulletin of Miscellaneous Information*, Royal Botanic Gardens, Kew, No. 2, pp. 72-76. London, 1915.

This article discusses the question of the effect of the age of the tree and its local conditions on the quality of the nuts for seed purposes. No evidence is obtainable to support the view that the nuts of young trees are unsuitable for seed purposes and it is considered sufficient to select nuts for planting purposes from trees in their third or fourth year of bearing. In this way a more complete pedigree, so essential to seed selection, is obtained.

Trees from selected nuts planted in Nevis (West Indies) came into bearing at 4 years 4 months and, out of 1000 seed nuts selected a year later, more than 89 per cent germinated.

005 – **Three New Vegetable Waxes from Madagascar.** — HÉBERT, A. and HEIM, F., in *Ministère des Colonies, Bulletin de l'Office Colonial*, Year, 8, No. 86, pp. 96-101. Melun, February 1915.

Three new plants producing vegetable wax have recently been recorded as growing wild in the desert region of the Southern part of Madagascar: *Cynanchum messeri* (= *Vohemaria messeri*), Asclepiadaceae, and *Euphorbia xylophylloides* and *E. stenoclada*, Euphorbiaceae.

The wax can be obtained from these plants in two ways: 1) the plant is cut in pieces and these are dried and pounded on a cloth; the powder thus obtained is thrown into boiling water from which the scum is removed; 2) the branches are immersed in boiling water, the wax separates out by liquefaction and is collected by skimming. The second method is more rapid, but less productive than the first. A normally developed plant of *E. xylophylloides* gives about 2 lbs. of raw wax by the second method and almost double by the first; *E. stenoclada* gives a little less. In comparison to the weight of the plant, *Cynanchum messeri* produces the highest percentage of wax, six small plants yielding 7 oz. The plants in question are very plentiful in the South of Madagascar and could probably be collected throughout the year; one native could collect and prepare 9 or 10 lbs. of wax per day. Samples analysed by the writers showed the following characters:

	E. stenoclada	*E. xylophylloides*	*Cynanchum messeri*
Melting-point	88°C.	88°C.	88°C.
Free acids (mgm. of potash per gm. of wax)	19.3	28	17.7
Total acids (mgm. of potash per gm. of wax)	140	142.8	159.6
Fixed iodine % of wax	5.9	5.3	3.2
Volume of hydrogen at 0°C and 760 mm, furnished by 1 gm. of wax . . . cc.	73	65	88
Hydrocarbons % of wax	15	14	11

The melting point of these waxes is higher than that of other vegetable waxes (47 to 54° C.) or of beeswax (63 to 64° C.). They resemble in their other properties the other vegetable waxes (especially those from China and Japan), differing from them in containing an amount of hydrocarbons comparable with that in beeswax.

The proximate analysis of the waxes under discussion showed the presence in them of small quantity of free acids, near resins; alcohols, among which were cerylic and melissic; calcium palmitate; glycerides of palmitic acid; and entriacontane (C_{31} H_{64}).

606 – **The Thinning out of Hevea Rubber Trees in Malaya.** — SKINNER, B. E., in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 3, pp. 115-123. Kuala Lumpur, December 1914.

RUBBER, GUM AND RESIN PLANTS

On one estate the reduction of the number of trees from 200 to 90 per acre increased the yield of latex per tree by 80 per cent. On another estate where tapping was begun with 300 trees to the acre the yield gradually

increased to 900 lbs. per acre and then fell rapidly to about 400 lbs. per acre. The reduction of the number of trees to 100 and then to 60 per acre resulted in a steady increase in the yield of latex.

The advantages of thinning out are : economies in labour and apparatus, and improved health of the trees with ultimately an increased yield per acre.

A temporary disadvantage is the immediate growth of weeds, but an artificial check to their development is only required during the first season.

As far as possible the selection of the trees for removal should be determined by the previous yields of the trees. The gradual exhaustion of the trees before removal is not recommended as it tends to deteriorate the quality of the tapping, and it is doubtful if the amount of latex obtained compensates for the labour and the retardation of the improvement of the neighbouring trees.

SUGAR CROPS

607 – **The Varying Concentration of the Juice in the Cells of the Cane Stalk.** — NORRIS, R. S., in *The International Sugar Journal*, Vol. XVII, No. 195, pp. 127-128. London, March 1915.

It is well known that the concentration of the juice varies in different parts parts of the cane.

The writer has found that the density of the juice from different parts of the cane increases considerably with each succeeding pressing and that with very heavy pressures the juice extracted at the last pressing was in one case more than twice the density of the first expressed juice.

After separation of the parenchyma from the fibro-vascular cells there was no increase in the density of the last expressed juice, thus suggesting that there are some cells containing juice of very high concentration and that these cells are more resistant to crushing than the surrounding cells. There is therefore an advantage in reducing the cane to a fine state of division, either by shredding or by grinding, before milling.

608 – **The Palmyra Palm *(Borassus flabellifer)* as a Source of Sugar** (1). — GHOSH, M. N. (Assistant Professor of Chemistry and Physics, College of Agriculture, Bihar and Orissa), Vol. II, pp. 87-88. Patna, 1914.

The juice of the Palmyra palm is collected twice a day, in the morning and evening, but owing to fermentation the juice collected in the evening is not suitable for the production of sugar. This trouble may be prevented by coating the inside of the collecting cups with lime, or washing them with formalin. Smoking the pots after cleaning also acts as a preventive of fermentation, but the best results are obtained with formalin.

Five or six pots may be hung on a full grown tree during the flowering season and a total of from 12 to 15 lbs. of juice obtained. The juice contains about 12 per cent of saccharose and is remarkably free from glucose (non crystallisable sugar). The yield of gur' or crude sugar is about 1 ½ to 2 lbs. per tree per day or 200 lbs. per annum.

(1) See also *B.* June 1913, No. 671. (*Ed.*).

At present the tree is seldom cultivated, but is planted along the boun-aries of plots of land. As suggested by ANNETT, it is very probable that in aces where it is grown side by side with the date palm (*Phoenix sylvestris*) hich produces its sugar during the cold season, a sugar factory would be ble to work with profit throughout the year.

09 - **Cultural Operations Capable of Producing an Increase of Sugar in Maize Stems** (1). — MUNERATI, O., and MEZZADROLI, G., in *Atti della R. Accademia dei Lincei, Rendiconti*, Vol. XXIV, Part 5, First Half-Year, pp. 450-456. Rome, March, 7, 1915.

After having given a summary of the previous work on this subject, he writers contribute an account of experiments carried out by them in 913 and 1914. They first compared the saccharose-producing quality f Giant Serbian maize, suggested by HECKEL, with that of a large-growing ariety, the Friulotto, of the valley of the Po. Subsequently in 1914, they onfined themselves to the latter variety and studied the various methods f treatment and their effect on the plant. The experiments of these two ears have now allowed the writers to draw certain conclusions, of which he following are the most important.

1. The increase in saccharose is greatest when the immature cobs and assels are removed at the same time. The Friulotto variety has proved to ossess a greater saccharose-forming property than Giant Serbian.

2. Removing the cob without the sheath gives a slight increase in he capacity for accumulating sugar.

3. Within certain limits, it seems that topping is of use in increas-ng the value of maize stalks as a feed.

4. From the cultural point of view, on account of the diseases to hich it is subject, maize as a sugar-producing plant is greatly inferior to ugar-beet.

5. The presence of a considerable amount of impurities, in the form f molasses-containing substances difficult to eliminate, gives the plant n almost negative value for the industrial extraction of sugar.

10 - **Coffee in the Philippines** (2). — WESTER P. J. (Horticulturist), in *The Philippine Agricultural Rewiev*, Vol. VIII, No 1., pp. 39-46. Manila, P. I. 1915.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

Arabian coffee cannot be grown successfully in the Philippines below n altitude of 800 metres, and even at this elevation, owing to its usceptibility to the coffee blight, extensive planting of Arabian coffee annot be recommended. Considering the success of *Coffea robusta* in Java nd Malaya the writer recommends this variety to Philippine planters (3).

(1) See *B.* May 1913. No 512 ; *B.* July, 1914, No. 631 ; *B.* May, 1915, No. 540. (*Ed.*).

(2) See also *B.* May 1915, No 511. (*Ed.*).

(3) It should be noted, however, that though this variety is most resistent to the blight and ives heavy yields, the quality of the coffee obtained is inferior and, according to the report of ne Director of Agriculture Federated Malay States (this *Bulletin* Feb. 1915, No. 135) the rea under *Coffea robusta* is diminishing owing to the low price of the product. The same report lso recommends the planting of Liberian coffee with Coconut. (*Ed.*).

611 – **Manurial Experiments on Cacao 1913-14.** (1) — VERTEUIL, J. DE (Superintendent of Field Experiments) in *Bulletin of the Department of Agriculture*, Vol. XIV, Part 1, pp. 1-16, + Diagr. 1-8. Trinidad, 1915.

This report deals with the third year's results of the manurial experiments on cacao and contains the results of the natural yield plots for the last two years. Although the rainfall was less than during the previous year the weather conditions were more favourable owing to the even distribution of the rainfall, and the yield of cacao for the whole Colony is the greatest on record.

The highest and lowest yields of the untreated plots are given in the following table :

Number of Estate.

	1		2		3		4		5		6		7		8	
	Average number of pods per tree.														lbs of wet cacao per acre	
	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914	1912-1913	1913-1914
Highest (of 20 plots)	31.2	44.4	23.8	37.9	30.6	44.6	27.0	34.0	35.2	36.9	54.5	47.3	55.9	57.5	2 255	1 989
Lowest (of 20 plots)	8.52	17.3	14.2	17.5	14.0	23.0	12.90	19.5	18.4	19.4	18.67	9.3	30.6	35.9	1 132	1 074
Difference..	22.7	9.6	9.6	20.4	16.6	21.6	14.1	14.5	16.8	17.5	35.8	38	25.3	21.6	1 123	915

These results have been obtained without the application of any manures and with identical cultivation for all the plots. The differences are therefore due to seasonal variations and to the increasing age of the trees. The differences in the yields of the various plots of the same estate are not uniform and do not increase or decrease in the same proportion from one year to another.

The manurial experiments were carried out on 8 estates with from 9 to 14 plots each, using the following manures in various combinations: basic slag, sulphate of potash, sulphate of ammonia, nitrate of soda, bone meal, superphosphate, calcium cyanamide, lime, calcium nitrate, pen manure, mulch. On every estate but one the yields of all the plots exceeded those of the previous year, and the increased yield was greater in the case of the manured plots than in the case of the controls on four estates only, whilst in 2 cases the increased yield of the controls was greater that than of the manured plots.

No realiable conclusions can be drawn as to the respective values of the various manures used.

(1) See also *B.* Febr. 1915, No. 180. (*Ed.*).

These experiments, as in the case of coconut experiments (1), show the necessity of ascertaining the natural yields of the plots over a series of years before applying the manures.

12 – **Ash Manna: Production in Italy; Composition; Adulteration.** — MAROGNA, G., in *Annali della R. Stazione Chimico-Agraria sperimentale di Roma*, Series, II, Vol. VII, Part 2, pp. 77-145. Rome, 1915.

At the present time, the manna-producing Ash is cultivated only in Sicily, and chiefly in the neighbourhood of Palermo and Cefalù, where it covers an area of about 13 800 acres. It is represented by many species or varieties, *viz.*: *Fraxinus ornus rotundifolia, F. o. angustifolia, F. fraxinaster oxyphylla, F. f. australis, F. f. excelsior.* The *Ornus* section gives the best quality manna; the *Fraxinaster* section produces a manna that is much inferior, but it is collected before the autumn rains and is much more plentiful. The exportation of Italian manna is continually increasing: in 1900 the exports amounted to 173 tons, of the value of £34 900, and in 1913 to 344 tons, worth £97 100. The product goes chiefly to South and Central America. Part of the crop is used in Sicily for the extraction of mannite.

The analyses of manna hitherto made are few in number and not very concordant, further it is not certain that all the specimens analysed were

Limits of the Variations in Composition of Genuine Manna.

	Moisture	Mannite	Reducing sugars		Rotatory power $[\alpha]_D^{20}$		Ash	Insoluble foreign substances
			Before hydrolysis	after hydrolysis at 100° C	Before hydrolysis	after hydrolysis at 100° C		
	%	%	%	%			%	%
Capaci Manna: (*F. Ornus*)								
stick	6–9	54–61	10–15	27–34	30–35	10–14	0.76–1.27	0.1 0.2
broken	5–9	41–52	10–16	33–44	34–48	12–16	1–1.40	0.2–0.5
common	4–6	32–37	11–16	44–55	51–62	15–26	1.3–5.5	1.0–8.2
Geraci Manna: (*F. Ornus*)								
broken	6-8	50–51	12–13	34–36	35–39	13–14	1.72 2.1	1.3–1.6
Castelbuono Manna: (*F. Fraxinaster*)								
stick	11	54	12	26	35	13	1.34	0.8
grocer's	6–8	46–48	11–12	26–29	28 37	10–15	2.38–3.5	3.3–9.5
industrial	6–8	33–34	13–14	34–36	40 41	14–15	2.57–3.65	14.5–18.0

(1) See also *B.* Febr. 1915, No. 180. (*Ed.*)

genuine. The writer has collected and analysed a good number of genuine samples of manna, to try to fix limits within which the composition of the different qualities of the drug may vary. The data obtained are summarised in the accompanying table.

The writer describes a method of manna analysis devised by himself and the means of detecting the most common forms of adulteration.

VARIOUS CROPS

613 – **The Products Obtained from the Dum Palm in Eritrea** (1). — *Ministero delle Colonie, Ufficio Economico, Bollettino di Informazioni*, Year II, No. 12, pp. 928-930. Rome, December 1914.

In Eritrea, the dum palm (*Hyphaene* spp.) grows wild in the valleys of the Barca and many of its tributaries, as well as in the valleys of the Gasc and the Setit, generally occupying a zone 30 to 150 yards or more wide along the banks. Groves of some importance are also found in the territory of Assab, and some scattered examples are to be seen in the Samhar.

The principal product of the dum palm is the kernel of its fruit, which yields a vegetable ivory. In 1913, some 4200 tons of these fruits were exported from Eritrea having a value of £57 000.

The leaves, when incompletely developed, are dried, cut into strips and interwoven to form mats; the annual value of this native product is about £3000 to £4000. From the fibre of the dry leaves ropes and vegetable horse-hair are also made. The petioles, which are 2 to 5 ft. long, are employed by the natives for making lattice-work, screens and similar objects.

The natives of Dancalia are in the habit of cutting off the young shoots of the dum palm and collecting the sap flowing from the topped branch; on fermenting, this sap gives a sweet and very alcoholic beverage called *duma*.

Before the fruit is completely ripe, the outermost half inch of the hull is soft and sweet and serves as an article of human food wherever the dum palm grows. For some time it has also been used with success as a feed for working animals. Recent investigations have shown that an excellent alcohol can be recovered from it. The dry fruits furnish a good fuel.

The wood is used by the natives for hut-building; it has, however, little value as timber, for although the cortex is very hard, the interior is somewhat soft and devoid of resistance.

MARKET GARDENING

614 – ***Akebia quinata* and *Decaisnea fargesii* (Lardizabalaceae), Edible Fruits from China and Japan.** — De Vilmorin *in Bulletin de la Société Nationale d'Acclimatation de France*, Year 62, No. 3. pp. 89-93. Paris, March 1915.

Akebia quinata and *Decaisnea fargesii* have been known in Europe as ornamental shrubs for about three-quarters of a century, but they did not produce seed for a considerable time. The fruits of *Akebia* have recently been obtained in Italy and France (Toulouse, Bordeaux) and those of *Decaisnea* in France only since 1898.

The fruits are remarkable for their beauty and, although not of very

(1) See also *B.* June 1914, No. 526. (*Ed.*)

delicate flavour, they are worthy of a place with other autumn fruits on account of their beautiful colour effects. The edible portion of these fruits is a whitish semi-consistent pulp with a slightly sweetish taste. The fruit of *Akebia* is composed of a subcylindrical fleshy envelope, slightly flattened and rounded at the extremities; it opens along a median line showing a whitish transparent pulp in which are embedded rows of black seeds. Solitary fruits hang vertically and attain a length of 2½ to 3 inches; the colour is a beautiful violet darkening to cobalt blue, while the pulp has a milky white colour. The fruit of *Decaisnea*, described by the writer in 1910 (1), grows to a length of 3 or 3 ½ inches.

Akebia requires a good fertile soil and appears to be affected only by stagnant moisture. *Decaisnea* also grows well in all good garden soils; it withstands the cold well, but should be planted in the higher situations of the garden to escape spring frosts. Under these conditions it bears fruit each year.

615 – **Native North American Species of *Prunus* and Varieties of Plums derived from Them.** — I. WIGHT, F. W. (Botanist, Office of Horticultural and Pomological Investigations) The Varieties of Plums Derived from Native American Species. *U. S. Department of Agriculture, Bureau of Plant Industries, Bulletin* No. 172 pp. 1-44; Washington, March 13, 1915. — II. WIGHT, F. W. Native American Species of *Prunus*, *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 179; pp. 1-75 + 13 plates, Washington, April 2, 1915. FRUIT GROWING

The development from the wild condition and the introduction into cultivation of the varieties of plums enumerated and described in this paper has taken place mostly within the last fifty years.

No other native North American fruit, with the exception of the grape, has given rise to so many varieties as the plum. The State of Iowa alone has furnished 175, while 74 have come from Minnesota, 44 from South Dakota, 97 from Texas etc. The present paper proposes to identify the species to which every variety belongs and to trace its parentage and origin. A first list contains the varieties classified by species, a second list contains the native varieties and hybrids arranged in alphabetical order and shows the origin of each variety and the species to which it belongs. The varieties thus enumerated are about 800 (without reckoning the synonyms).

II. — The present study embraces only those species of the genus Prunus which have an umbellate or corymbose inflorescence and which produce plum-like or cherry-like fruit, those being the ones principally of interest, either from the stand-point of their fruit production or their utilization as stocks in the propagation of other species. Indeed, the American species belonging to the subgenera *Padus*, *Laurocerasus*, and *Emplectocladus* seem sufficiently distinct to warrant the recognition of these groups as genera.

The genus *Prunus* is widely distributed in America, being represented in some portion of every state by one or more species, from the north-east of Mexico to the southern provinces of Canada. Eight species are found in

(1) *Bulletin de la Société d'Acclimatation*, 1910, p. 477.

Texas and it is probable that the greatest abundance of individuals is in the region comprising Missouri, eastern Kansas, Oklahoma, western Arkansas, north-western Louisiana and northern and eastern Texas.

There is great variation within the species in the size and quality of the fruit and apparently in the productiveness of individual trees. Several of the American species bear fruit that is distinctive in character and that posseses qualities of value. They are all remarkable for their hardiness. Some of them may eventually be so improved as to compete with varieties originating from Old World species.

Up to about 1850 the native species held a relatively very unimportant place in American pomology. As the population of the country increased and spread westward, beyond the region in which European varieties of plums were successfully grown, the native species began to be more and more utilized, and this tendency was furthered by the ravages of the curculio and the belief of many that native plums were less affected by the insect.

While the first name for a native plum that may be termed "varietas" in the pomological sense seems to have been published in 1867, there have now been applied, either to varieties of the native species or to their hybrids, more than 800 names.

The botanical treatment proposed by the writer has been based on a study of nearly all the species in the field, of more than 400 horticultural varieties and of several collections and herbaria. After giving a synopsis of the species and a botanical key, he gives descriptions of the species and their hybrids and lastly a bibliography of 76 works. The synopsis of the species is as follows:

PLUMS.

Americana group:	*P. nigra; americana; mexicana.*
Subcordata group:	*P. subcordata; subcordata oregana.*
Hortulana group;	*P. hortulana; hortulana minori; reverchonii rivularis.*
Angustifolia group:	*P. munsoniana; orthosepala; angustifolia; angustifolia watsonii; angustifolia varians.*
Maritima group:	*Prunus alleghaniensis; alleghaniensis davisii; Prunus umbellata; umbellata injucunda; umbellata tarda; gravesii; maritima.*
Gracilis group:	*Prunus gracilis; venulosa.*

CHERRIES.

Prunus pennsylvanica; pennsylvanica corymbulosa; emarginata; emarginata villosa.

DWARF CHERRIES.

Prunus pumila; cuneata; besseyi.

616 – **Citrus Fruits in the Philippines.** — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. VIII, N° 1, pp. 5-28. Manila, P. I., 1915.

A description of most of the more distinctive Philippine citrus fruits including several new species. The species described are:

Citrus auriantium L.
C. vulgaris Risso (Orange)
C. nobilis Lour. (Mandarin)
C. nobilis var. *papillaris* Blanco (Tizon)
C. decumana var. *Panuban* (Grape fruit)
C. mitis Blanco (Calamondin)
C. webberii (Alsem)
C. webberii var. *montana* (Cabugao)
C. longispina (Talamisan)
C. macrophylla (Alemow)
C. southwickii (Limão)
C. histrix D. C. (Cabuyao),
C. histrix var. *boholensis* (Canci)
C. histrix var. *torosa* Blanco (Colobot)
C. micrantha var. *microcarpa* (Samuyao)
C. medica L. (Citron)
C. medica var. *odorata* (Tihi-tihi)
C. medica var. *nanus*
C. limonum Risso (Lemon)
C. pseudolimonum (Colo-colo)
C. limetta Risso (Lime)
C. limetta var. *aromatica*
C. excelsa (Limon Real)
C. excelsa var. *davaoensis*.

Of the new plants the "Tizon" (*Citrus nobilis* var. *papillaris*) is a dessert or breakfast fruit of the highest order, its main defect being the unsightly basal projection; the "Limon Real" (*C. excelsa*) or Royal lemon is unsurpassed for making drinks; the "Alsems" (*C. webberii*) are suitable for the manufacture of citric acid; the "Talamisan" (*C. longispina*) is juicy and thin skinned and may be used as a dessert fruit or for making drinks; the "Panuban" (*C. decumana*) is of good flavour but lacking in juiciness; the "Calamondin" (*C. mitis*) is a good marmalade fruit.

These species may also have considerable advantages as stocks. The Calamondin is a dwarf species and is drought resistant, the "Cabuyao" is very vigorous and also drought resistant; the « Limão » and the "Talamisan" are also drought resistant, the latter being also useful as a live fence on account of its large spines; the "Limon Real" is also very vigorous.

617 - **Evaporation and Soil Moisture in Relation to the Succession of Plant Associations.** — I. FULLER G. D. Evaporation and Soil Moisture in Relation to the Succession of Plant Associations, in *The Botanical Gazette*, Vol. LVIII, No. 3, pp. 193-234, 27 figs. Chicago, Ill., September 1914. — II. WEAVER, JOHN E. Evaporation and Plant Succession in South-eastern Washington and Adjacent Idaho, in *The Plant World*, Vol. 17, No. 10, pp. 273-294, 10 figs. Tucson, Arizona, October 1914. FORESTRY

I. — At the southern extremity of Lake Michigan the following succession of plant associations occurs: 1) cottonwood dune (*Populus deltoides*); 2) pine dune (*Pinus banksiana*); 3) oak dune (*Quercus velutina*); 4) oak-hickory forest (*Quercus alba, Q. rubra*, etc.); 5) beech-maple forest (*Fagus grandifolia, Acer saccharum*). This represents a continuous series from the pioneer cottonwood trees invading the dune to the mesohpytic climax forest of the region. Investigations of evaporation in the lower layers of the various zones were made from May to October in 1910, 1911 and 1912, using the LIVINGSTON porous-cup atmometer, as well as determinations of soil moisture; for comparison an edaphic prairie (as developed in the neighbourhood of Chicago) was also included.

Comparison of the daily evaporation determinations with the corresponding meteorological data of the Chicago Weather Bureau shows that the evaporation in the air represents an accurate summation of all the atmospheric factors that may be related to the water content of the aerial parts of plants. The character of the succeeding vegetation is therefore deter-

mined by the evaporation rates in the lower aerial stratum and the range of soil moisture in the upper subterranean strata.

The rate of evaporation in the cottonwood dune association, on account of its great amount and excessive variation, is sufficient to account for the xerophytic character of the vegetation and the absence of undergrowth, in spite of the constant presence of growth-water. The pine and oak dune associations resemble one another closely, both in their mean evaporation rates and in their supply of growth-water; though the former is slightly more xerophytic during the midsummer period. The evaporation rates and the amount of growth-water in the various associations vary directly with the order of their occurrence in the succession, the first association being the most xerophytic in both respects. From the ratios of the growth-water to rate of evaporation the mesophytism of the various associations is represented by the following numbers:

Beech-maple forest	100
Oak-hickory forest	65
Oak dune	20
Pine dune	17
Cottonwood dune	15
Prairie	62

These differences are sufficient to account for the succession of the various associations.

II. — A study of the ecological conditions in South-eastern Washington and adjacent Idaho was made with the object of pointing out the sequence of succession and to determine the comparative rates of evaporation in each of the major associations. The associations studied include: 1) bunchgrass-rimrock (dominated by tufts of *Agropyrum spicatum*); 2) prairie (varying according to exposure); 3) open yellow-pine association (*Pinus ponderosa*); 4) Douglas fir and tamarack association (*Pseudotsuga mucronata, Larix occidentalis*); 5) cedar association (*Thuya plicata*). The last three occur at increasing heights in the hills.

Following FULLER'S suggestion that a plant association of wide distribution (*e. g.* the beech-maple forest) may be used as a basis for comparison of evaporation rates, the evaporation in the cedar association from July 14 to September 21 is only 0.5 cc. per day greater than in the beech-maple forest. In the fir-tamarack association from May 10 to September 5 atmospheric conditions in the lower stratum are 120 per cent as severe, in the average formations of the plains 250 per cent and in the bunchgrass-rimrock association 345 per cent as unfavourable to plant life as regards evaporation.

The evaporation rates at different stations in the same association show variations both in character and degree, and these variations in the rate of evaporation gradually become less and less as the climax type of vegetation is approached. A study of the differences in the rates of evaporation in various plant formations and associations shows that these differences are sufficient to be important factors in causing succession, at least during the earlier stages, where light values are usually high.

618 – **Growth Studies in Forest Trees: *Pinus strobus*.** — BROWN, H. P., in *The Botanical Gazette*, Vol LIX, No. 3, pp. 197-241 + 2 Plates. Chicago, March 1915.

This is a continuation of previous work on *Pinus rigida* (*Botanical Gazette*, 54, p. 386, 1912). The object of the investigation is to clear up some disputed points regarding the formation of annual rings and to outline the laws of growth in trees. *Pinus strobus* was used in these studies since it differs from the hard pines in both external and internal anatomy, and, on account of its more rapid growth and commercial importance it is more likely to yield interesting results.

The specimens were all in a wild state and not limited to one locality. Incisions were made on trees at intervals from base to crown and always on the south side of the tree, unless otherwise stated. Each cutting included all or a portion of the inner bark, the cambium, and all of the preceding year's ring, except toward the end of the season, when the growth of the rings had become so thick as to make this impracticable. Duplicate cuttings were made at short intervals close to the former. The results are summarised as follows: *a*) the number of cells in the cambium layer is smallest in the twigs and young branches and increases gradually in dimensions from the apex downwards until the region of the thickest annual ring; *b*) phloem development continues late in the autumn after the growth of the xylem has ceased; no compression occurs as late as October, but with the extreme temperatures of winter contraction occurs and all the seasonal growth of the phloem is crushed, especially in the crown; *c*) growth in white pine is divisible into 1) growth without cell division and 2) growth with cell division; the first begins in the phloem in March and is apparently due to the rise of soil water with an accompanying increase in temperature; *d*) growth by cell division begins during the last half of April in the bole, some distance below the apical shoot, and spreads upwards and downwards with the result that growth at the base of the tree may begin several weeks later than in the crown; *e*) since moisture and available food supply reach an optimum in spring the rate of growth is directly proportional to the prevailing temperatures; *f*) there are two periodic optimums of growth intensity, one during May and early June and the second in July and August; *g*) retardation of growth begins in the upper portions of the tree and may continue vigorously below for some weeks longer; *h*) elongation of new shoots and leaves is simultaneous and begins early in May; it appears only after xylem formation has begun; *i*) the formation of autumn wood begins during the first half of August and is associated with a decrease in growth intensity which begins in the higher parts of the tree.

619 – **The Use of Sewage and Garbage for Manuring Forests** (1), — SCHWAPPACH, in *Zeitschrift für Forst- und Jagdwesen*, Year XLVII, Part 4, pp. 249-256. Berlin, April 1915.

Experiments with sewage water. — These experiments were conducted on a 40-year-old plantation of Scots pine (*Pinus sylvestris*) on poor sandy soil. Three floodings per year were made, in May, June and July, at the rate of 16 inches each, during 1908, 1909 and 1910. Out of 1102 trees in the

(1) See *B.* Dec. 1910, pp. 293-294. (*Ed.*).

stand, 456, or 41 per cent, were dead in 1911, and as the mortality continued it was necessary to clear up the ground, whilst the untreated portion continued its normal development. The writer is of opinion that this injurious effect of the sewage water was due to the rise of the subsoil water, and in the light of observations in another stand of Scots pine occasionnally flooded, he concludes that in sandy soil this tree is unable to survive the saturation of its root range for any considerable time.

Applications of sewage by infiltration to transplanted nursery trees gave good results, especially with alder, also with oak (the taproot of which made remarkable growth), Scots pine and spruce, but unfavourable results in the case of larch.

In another series of experiments between 1908 and 1914 on replanting with Scots pine, Sitka spruce, red oak, ash and white poplar, the application of sewage water by infiltration was unfavourable to Scots pine, Sitka spruce and red oak, but favourable to ash and white poplar.

The results of these experiments are summarised as follows :

1. An appreciable rise in the subsoil water so as to occupy the root-space is injurious to Scots pine during the growing period and even for short periods of time, whether sewage or pure water is used.

2. The intensive application of sewage water to plantations of Scots pine on sandy soil is not recommended, since it is liable to be fatal to the trees.

3. It is only in the first stage of growth that pines and spruces benefit by irrigation, which becomes injurious to all conifers after some years of growth.

4. Irrigation is of considerable value to some broad-leaved trees, especially poplar, ash and alder, also for bird-cherry and false-acacia; it also favours the development of the roots of the common oak, but is injurious to the red oak.

Experiments with garbage. — These experiments were carried out in 1909 in a plantation of Scots pine 45 years old and of the IVth class; the water was applied in a layer 8 to 12 inches deep. The percentage increases of the two sections were:

	1909-11	1912-14
Control plots	2.5	1.3
Manured plots	2.4	2.6

Although appearing late, the favourable action of the garbage is obvious and such as to recommend its use. Owing to economic conditions, it could only be applied on a large scale in a few cases.

620 – **Contribution to the Knowledge of Some of the Timbers of Eritrea.** — Senni L., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo.* Vol. I, Part 2, pp. 159-168. Palermo, 1915.

A study of the timber of:

Acacia glaucophylla, A. verugera, Acokanthera schimperi, Adansonia digitata, Apodytes dimidiata, Avicennia officinalis, Calpurnia aurea, Cassia tora, Celastrus laurifolius, C. senega-

lensis, Clematis sp., *Coleus igniarius, Combretum trichanthum, Dichrostachys nutans, Dodonaea viscosa, Euclaea kellau, Juniperus procera, Kigelia aethiopica, Lonchocarpus laxiflorus, Maesa lanceolata, Mimusops kummel, Nuxia dentata, Odina fruticosa, Olea chrysophilla, Otostegia repanda, Rhus glaucescens, Sclerocarya birroea, Sponia orientalis, Sterculia triphaca.*

Of these trees the following supply valuable timber: *Apodytes dimidiata*, of uniform structure, silky, fine-grained and very hard, but withoubeing difficult to cut; *Coleus igniarius*, excellent fuel; *Combretum trichanthum*, a fine wood taking a high polish; *Juniperus procera*; *Mimusops kummel.*

The specific gravity of certain Eritrean woods, determined from seasoned samples taken from the trunks, was as follows:

Acacia etbaica	1.187	*Cordia* sp.	0.570—0.630
» *Senegal*	0.885	*Dalbergia melanoxylon*	1.280
» *spirocarpa*	0.672	*Dobera glabra*	0.645
» sp.	0.952	*Ficus vasta*	0.439
Albizzia anthelmintica	0.820	*Hyphaene thebaica*	0.512—0.640
Anogeissus leiocarpa	0.832	*Olea chrysophylla*	1.250
Balanites aegyptiaca.	0.750	*Rhus* sp.	0.810
Celastrus sp.	0.690	*Terminalia Brownii*	0.939
Celtis sp.	0.697	*Trichilia emetica*	0.525
Cordia ovalis	0.480	*Ximenia americana*	0.960

LIVE STOCK AND BREEDING.

621 – **Poison Plant Investigations in Western Australia.** (1). — STOWARD, F. (Botánist and Plant Pathologist) in *Department of Agriculture and Industries of Western Australia*, Annual Report for the Financial Year ended 30th. June, 1914. pp. 31-32. Perth 1915. HYGIENE

In a series of experiments on the toxicity of certain species of native leguminous plants, notably the York Road Poison, (*Gastrolobium calycinum*, Benth) some rabbits were fed almost daily with leaves of the plant from April to October. The writer found that up to the end of September the leaves were not poisonous, while in October, when the plant fruits, the rabbits died after consuming a small ration of the same leaves.

From several farms along the southern line reports were received early in the year of losses of sheep, apparently through plant poisoning. In the localities indicated the writer observed the presence of the Pimpernel or Shepherd's Weather Glass (*Anagallis arvensis* L. var. *coerulea*). This plant contains a saponin and has narcotic properties and when eaten in quantity may cause poisoning.

622 – **Results of Continued Injections of Tuberculin upon Tubercular Cattle.** NELSON, S. B. in *State College of Washington Agricultural Experiment Station, Pullman, Washington, Division of Veterinary Science, Bulletin* No. 14, pp. 15, Pullman, 1914.

The veterinary department of the Pullman Agricultural Experiment Station carried out a series of experiments to study the effect of subcu-

(1) See *B.* Feb. 1915, No. 137. (*Ed.*)

taneous injections of tuberculin into cattle in the conditions under which they are generally kept; that is: a fairly well kept stable in the winter time, being out of doors a part of the day time; and a run to pasture during the summer months, being kept in the barnyard at night.

The first series of experiments were carried out during the year 1900, and the second during 1903-07.

The chief results obtained were the following:

1. *The injection into tubercular cattle of large monthly or small weekly doses of tuberculin is apparently without any therapeutic value.*

The monthly injections were given as follows: one cow received the first injection of 4 cc. January 14, 1904 and the last of 8 cc. February 13; another cow received her first injection of 4 cc. on January 14, 1904. At each successive injection the dose was doubled till the last reached 2048 cc. on November 25, 1904.

2. *The injection of continually increased daily or weekly doses of tuberculin appparently does have a therapeutic value.*

The weekly doses began with 2 cc. and increased every week by 1 cc. With one cow the last dose was 16 cc.; with another 150 cc.

The daily injections were preceded by a weekly injection 2 cc. The period between each succeeding injection was then curtailed by one day until it became daily. On every subsequent day the dose was then increased by 0.5 cc.

3. *In tubercular cows the evening temperature is usually higher than the morning temperature.*

4. *The more often tuberculin injections are made into tubercular cattle, the sooner the temperature reaction begins and the sooner the maximum is reached.*

623 – **Acclimatisation Experiments with European Cattle at Parana (Brazil): Results of Immunisation against Pyroplasmosis** (1) DUPONT, O., in *Revista de Veterinaria e Zootechnia*, Year IV, No. 6, pp. 344-347. Rio de Janeiro, December 1914.

The Ministry of Agriculture, Industry and Commerce of Brazil has carried out acclimatisation experiments at the model farm at Ponta Grossa (Parana) with bulls, heifers and cows of the Aberdeen Angus breed imported from Great Britain. Shortly after their arrival at the farm the animals were artificially infected with pyroplasmosis and developed symptoms of the disease from the 5th to the 20th day after infection. Three of the animals received an injection of trypan-blue a short time after the appearance of fever and pyroplasma in the blood; three others received the injection 3 or 4 days after the attack; the remaining four received no injection. The injections were all intravenous and made with strong doses (150 to 200 cc. of a 1 per cent solution). In addition to the pyroplasma the presence of *Anaplasma marginale* was also observed in all the animals. The result showed that with NUTTAL'S method well applied, it is easy to immunise European cattle against pyroplasmosis without loss. This method also confers great

(1) See also *B* Feb. 1913, No. 145. *(Ed.)*.

resistance to adult or pregnant animals. Anaplasmosis is a more serious disease and no specific treatment has yet been found. A first attack of this disease in the spring did not prevent a second more violent attack in some animals during the summer. Pregnancy, especially if the animal is fat, appears to be very prejudicial to resistance to anaplasmosis, owing to the serious complications in case of abortion. Young animals about one year old should therefore be chosen for importation, especially in the case of females, since acclimatisation takes nine months ; this is not because the disease is less virulent in young animals but because they resist it more easily. In acclimatising imported animals they should be kept under observation during 8 or 9 months and daily records of the temperature made, so that any animal showing a temperature above 39° C. (102 F.) can be immediately housed, protected from fatigue and given readily digestible rations. The writer proposes that the Brazilian Government make compulsory the acclimatisation of imported European cattle in an establishment under its immediate direction.

Since cattle were imported from South Africa to Parana 40 years ago there is no doubt that anaplasmosis is due to the same pathogenic organism in the two countries.

624 – **Hemorrhagic Septicemia of Buffaloes observed in Pigs in Hungary in 1913: its Treatment**. — Daróczy, János, in *Allatorvosi Lapok*, Year XXXVIII, No. 16, pp. 99-100. Budapest, April 17, 1915.

It is known that hemorrhagic septicemia of buffaloes is sometimes contracted by pigs in the same locality and that a great mortality may result. A case of this kind was observed in 1913 in the Mesa farm ; in a herd containing 183 breeding pigs of the Mangalicza breed, two animals succumbed unexpectedly in the night of November 2nd. Autopsy of the bodies showed a septicemia resembling hemorrhagic septicemia, which had been raging among the buffaloes of this region for some time. Of the other pigs only nine showed acute symptoms: prostration, watering of the eyes, dyspnœa, panting and staggering gait; in some cases fœtid and liquid excrement and a temperature varying between 39.5° and 40.8° C. (103° to 106° F.). was observed.

Considering the great value of the stock as well as the serious character of the disease, which threatened a high mortality, the writer, after trying several treatments unsuccessfully, had recourse to vaccination as prescribed against anthrax. To determine the dose of serum required, the live-weight of the pigs was taken as a basis, 10 cc. being used for pigs under 100 kg. (220 lbs) and 15 cc. for pigs above 100 kg. Before the arrival of the vaccine, seven of the nine diseased animals died unexpectedly and the contagion took a very high form in five other cases, two of which died after inoculation. A fortnight later the remainder of the herd was inoculated for the second time, and the whole herd removed to a distance from the place of infection ; after this the disease was checked.

The writer concludes that in the absence of a specific treatment for this disease, vaccination as against anthrax may be used effectively for both buffaloes and pigs.

FEEDS AND FEEDING

625 – **Net Energy Values of Feeding Stuffs for Cattle.** — ARMSBY, HENRY PRENTIS (Director) and FRIES, J. AUGUST (Assistant Director, Institute of Animal Nutrition of th Pennsylvania State College) in *Journal of Agricultural Research, Department of Agri culture*, Vol. III, No. 6, pp. 435-491. Washington, March 15, 1915.

In this paper the results are given of 76 experiments carried out or nine different steers with the aid of a respiration calorimeter in which th balance of matter and energy was determined. The losses of food energy are of two classes : 1. Losses of chemical energy in the faeces and urine and in the combustible gases (produced by the normal fermentations occur ing in the digestive tract) ; 2. Losses in the form of heat due to the increased metabolism consequent upon the ingestion of food (that is, quantity of hea consumed by digestion and assimilation).

1. *Losses of chemical energy.* — The losses of energy in methane and urine were relatively greater on light than on moderately heavy rations Neither the losses of energy in the faeces nor the total losses showed a distinct relation to the amount of food consumed.

Individual differences between animals had no very material influenc on the losses of chemical energy. The losses of energy in methane may be computed approximately from the amount of total carbohydrates digested From an average of 65 experiments the writers found the quantity o methane from 100 gms of digestible carbohydrates to range from a mi nimum of 3.8 mgs to a maximum of 5.5, or an average of 4.8. The figures obtained by KELLNER from 44 experiments were respectively 2.9, 5.5 and 4.2, thus somewhat lower than those obtained by the writers who propose to adopt the mean between 4.8 and 4.2, namely 4.5.

The metabolizable energy per kilogram of digested organic matte showed but slight variations within the same class of feeding stuffs Expressing the results in therms per kilogram and using for the apparen metabolizable energy of KELLNER and KÖHLERS feeding stuffs the figures computed by Armsby, the writers obtain the following averages :

Metabolizable energy per kilogram of digestible organic matter.

Coarse feeds.

ARMSBY and FRIES.		KELLNER and KÖHLER.	
Timothy hay	3.49	Meadow hay	3.5
Red clover hay	3.49	Oat straw	3.7
Mixed hay	3.39	Wheat straw	3.3
Alfalfa hay and meal	3.61	Extracted straw	3 6
Maize stover	3.45		
Average	3.48	Average	3.5

Concentrates.

ARMSBY and FRIES.		KELLNER and KÖHLER.	
Maize meal	3.80	Beet molasses	3.4
Wheat bran	3.99	Starch	3.6
Hominy chop	4.08	Wheat gluten	4 7

The most important factor influencing the metabolizable energy of the digestible organic matter of concentrates appears to be the percentage of fat in the feeding stuff. For ordinary dry feeding stuffs or mixtures and for an approximate calculation the following values may be taken :

Metabolizable energy of feeding stuffs per kilogram of digestible organic matter.

	Therms
Coarse feeds	3.5
Concentrated feeds with less than 5 per cent of digestible fat	3.9
Concentrated feeds with more » » » » » » »	4.0

2. *Losses of heat consequent upon feed consumption.* — The heat production is notably greater during standing than during lying, and the difference is greater on heavy than on light rations. The increment of heat production during standing is affected by the individuality of the animal and by the kind of feed consumed.

The writers analyzed in a series of tables how the total quantity of heat produced by one kilogram of dry matter, consumed in the form of some of the most common feeds, is distributed between standing, rising and lying down, fermentation and the remainder. The third columns of Tables III and IV give the average energy expended in food consumption per kilogram of dry matter of some feeds. In Table IV the above data are calculated from KELLNER'S showing the difference between the metabolizable energy of the digestible feeds and the quantity of energy gained by the animal, which difference gives approximatively the energy expended in food consumption.

The expenditure of energy arising from the consumption of the coarse feeds is not on the whole materially greater than in the case of the concentrated.

The increased muscular work of the digestive organs appears to be a relatively small factor of the increased heat production.

A scrub steer showed a somewhat greater increment of metabolism consequent upon feed consumption than did a pure bred beef animal.

3. *Net energy values.* — These may be determined directly or calculated from metabolism experiments or from the data of ordinary feeding tables. The net energy value is equal to the metabolizable energy minus the energy lost as heat. The metabolizable energy may be determined experimentally without special difficulty and with a good degree of accuracy by means of the ordinary metabolism experiment in which the energy of the food, faeces and urine is directly determined and that of the methane estimated from the amount of carbyhydrates digested. When this is not practicable the metabolizable energy may be estimated from the total digestible organic matter by the use of the factors given in tables I and II. In one or other of these ways it is not difficult to compute approximately the metabolizable energy of the more common feeding stuffs, while the subtraction from this of the average energy expenditure due to food consumption will give the net energy

value. The writers determined directly the values given in table III, and calculated on KELLNER'S tables those given in Table IV. The figures indicate small calories.

Net energy values of feeding stuffs per kilogram of dry matter.

TABLE III.

Feeding stuff	Gross energy	Losses of chemical energy	Energy expended in food consumption	Net energy values
Timothy hay	4 518	2 664	782	1 072
Red clover hay	4 462	2 461	962	1 039
Mixed hay	4 392	7 479	980	934
Alfalfa hay *	4 372	2 451	1 169	752
Maize stover	4 332	2 380	1 065	887
Maize meal	4 442	1 115	1 434	1 893
Wheat bran	4 532	2 021	1 177	1 334
Grain mixture N° 1	4 685	1 621	1 327	1 737
» » » 2	4 609	1 620	1 141	1 848
Hominy chop	4 709	1 187	1 365	2 157

* Includes alfalfa meal.

TABLE IV.

Meadow hay	4 433	2 260	1 254	919
Oat straw	4 436	2 848	1 014	574
Wheat straw	4 444	3 062	1 138	244
Extracted straw	4 147	1 013	1 160	1 974
Grass hay	—	—	1 045	803
Aftermath	—	—	958	747
Barley straw	—	—	877	747
Clover hay	—	—	932	811
Starch	4 152	1 101	1 248	1 803
Peanut oil	9 457	4 165	1 727	3 565
Wheat gluten	5 579	1 974	2 096	1 509
Beet molasses	3 743	945	988	1 810

The literature cited includes 54 works.

626 – **Comparative Efficiency for Growth and for Milk Production of the Nitrogen o Alfalfa Hay and Corn Grain.** — HART, E. B., HUMPHREY, G. C., and MORRISON F. B Comparative Efficiency for Growth of the Nitrogen of Alfalfa Hay and Corn Grain. —. II. HART E. B., and HUMPHREY, G. C., with the cooperation of WILLAMAN, J. J., and LAMB A. B. The Comparative Efficiency for Milk Production of the Nitrogen of Alfalfa Hay and Corn Grain. — *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* 33, pp. 87-107 and 108-119. Madison, Wisconsin, 1914.

It is well known that alfalfa hay, as well as other hays and root crops, contains a considerable part of its nitrogen in non-protein form. The nature of this nitrogen has not been exactly determined, but it is usually assumed to be a mixture of acid amids and amino-acids, and is generally described under the term " amids ". The writers have observed in the water extract of alfalfa hay, the presence of free amino groups, but that by no means all the amid nitrogen is in the form of simple amids or amino-acids. A large proportion is still more complex than these, and yet non-precipitable by such reagents as basic lead acetate and tannic acid.

There is a difference of opinion as to the real worth of " amid nitrogen " The question is to some extent connected with the question of the nature and extent of protein hydrolysis in animal digestion. From experiments carried out by many investigators it is apparent that the simple amino-acids have nutritive value and very probably represent a large proportion of the normal end products of protein digestion, and that with herbivora the " amids ", or non-protein nitrogen, can serve to maintain the protein tissues of the body, and there is certain evidence to show that they can also support milk production. Evidence is lacking that growth can be produced. It appears also that the value of these nitrogenous substances depends probably more upon the individual temperament and influence on appetite than to the class to which the animal belongs, though the idea prevails that herbivora can apparently make more efficient use of these substances than the omnivora or carnivora.

The plan of the writers' experiment was to secure data on the rate of nitrogen retention by growing heifers when the source of nitrogen in the ration was mainly either the maize grain or the whole alfalfa plant. The maize ration consisted of maize meal, gluten feed and corn stover. The alfalfa ration consisted mainly of alfalfa hay and maize starch and a small amount of maize stover.

A quantitative record of income and outgo of nitrogen was kept. The experiment was repeated twice. The nutritive ratios of the two rations were respectively 1: 8.2 and 1 : 9 in the 1910-11 experiments and 1 : 8.2 and 1 : 8.5 in those of 1911-12, or practically the same. These ratios are based on the crude digestible protein. If the amid nitrogen is not included, then the nutritive ratio becomes 1 :12.4. The total quantities of nitrogen in the daily ration were, in 1910-11, 106.45 gms. in the first ration and 105.68 in the second; in 1911-12 the corresponding figures were 111.45 and 113.02. The efficiency of the two rations for growth was essentially the same. The alfalfa ration contained sufficient quantities of protein to supply all the nitrogen retained by the animals; hence there is no proof that the amid nitrogen took part in supplying nitrogen for such storage. However, it is the

experience of feeders that a 1 : 12.4 ratio will not lead to rapid growth. One must therefore believe either that a nutritive ratio of 1 : 12.4 with alfalfa hay is as efficient for nitrogen storage as a 1 :8.2 as used in the maize ration, or that the amid nitrogen has been used for protein synthesis. Moreover, the failure of the amid nitrogen to increase or decrease the faecal or urinary nitrogen when the ration was suddenly changed, is very strong evidence that nitrogen was being used in ways similar to that of the nitrogen of true protein origin.

The writers call attention to the very great wastefulness of nitrogen by these growing animals. One of them, in a period of 42 days, received some 2700 grams of nitrogen, of which at least 1700 grams were absorbed from the intestine. Yet of these 1700 gms. absorbed, only 822 gms. were retained.

Conclusions. — On the basis of total nitrogen ingested, the utilization of nitrogen for growth was as efficient when the source was from alfalfa hay as when it came from the maize kernel. With high intake of total digestible crude protein, which in the case of alfalfa includes the amid nitrogen, the storage of nitrogen was essentially alike on the two rations. It is apparent that full value, at least for growth, can be given to the total nitrogen of alfalfa hay. The amid nitrogen should not be considered worthless. With growing heifers there was no marked agreement between the creanin output and the increased storage of nitrogen. This precludes the possibility of using this index for these animals as a measure of the efficiency of a given source of nitrogen to produce nitrogen storage.

II. — Cows in full lactation were fed on the maize ration and then changed to the alfalfa ration. These changes were repeated a number of times in order to study the nitrogen balance and the weights of milk yield.

For both rations the nutritive ratio was 1 : 7.7. The total nitrogen fed daily was 175.7 gms. in the maize ration and 173.7 gms. in the alfalfa ration. The digestible nitrogen was respectively 121.1 and 129 gms.

The data obtained indicate that the nitrogen of alfalfa hay is as effective for milk protein building as that of the maize kernel. The acid-amid nitrogen of alfalfa is very low in amount, constituting about 1 per cent of the total nitrogen, while the amino-acid nitrogen makes about 10 per cent of the total nitrogen. It is well established that amino nitrogen has nutritive value and that of alfalfa hay is probably not an exception. The experiments of the writers give no indication of the value of the acid amid nitrogen.

The real nutritive value of the nitrogen of roughages should rest upon the nature of the total amino-acid content derived from more complex proteins and pre-existing free amino-acids, rather than upon the proportion of amid nitrogen as found by the STUTZER method.

Alfalfa hay has specific diuretic properties and its ingestion was generally followed by a marked rise in the output of urine. This rise in renal activity caused a depression in the milk flow, which again rose in volume as the alfalfa hay was withdrawn from the ration. The diuretic stimulus in some cases caused a diminution of from 5 to 6 lbs. on a flow of 25 lbs.

daily. It is possible that this diuretic effect is due to salts contained in the hay; yet the possibility of the presence of specific substances of organic nature is not excluded.

627 – **Action of Dried Yeast, Potato Vinasse, Malt Coombs, and Palmnut Cake on the Yield and Fat Content of Milk.** — VÖLTZ, W.; BAUDREXEL, A., and DIETRICH, W., in *Landwirtschaftliche Jahrbücher*, Vol. 47, Part 4, pp. 573-638. Berlin, February 1915.

By means of numerous feeding experiments, the writers have sought to determine whether certain concentrated foods (dried yeast, potato vinasse, malt coombs, and palmnut cake), when mixed with various basal rations, have any specific effect on the quantity and composition of the milk.

For this purpose four cows of about 1000 lbs. live-weight were used. The experiments were made during two consecutive lactation periods comprising 12 series of trials and under essentially similar conditions. With a view to determining the effect of the supplementary concentrated foods, the experiments were divided into fortnightly periods on the basal ration, and experimental periods; in the latter each concentrated food at the rate of 2.96 lbs. of dry matter per cow per day was mixed with the basal rations of meadow hay, oat straw, malt coombs and potato flakes. The daily rations for each animal contained 11.3 lbs. of dry matter of malt coombs, a food material rich in amides, which was added to study its effect on the yield of milk. The cows were milked three times a day at first, and towards the end of lactation twice a day. In each period the following determinations were made: 1) quantity of forage consumed; 2) daily milk yield of each cow; 3) quantity and composition of each day's mixed milk; 4) composition of the milk from each cow on a given day.

These experiments showed that in all the experimental periods the supplementary concentrated foods (palm cake, yeast and vinasse) had almost equal effects on the yield of milk; 1 lb. of dry matter increased the yield about 0.54 lb. on an average; 1 lb. of dry matter of the three concentrated foods increased the fat content as follows: palm cake by 0.041 lb.; yeast by 0.024 lb.; vinasse by 0.006 lb. The insignificant effect on the secretion of milk of the concentrated foods rich in protein when added to mixtures of selected foods leads to the conclusion that these rations already contained sufficient protein matter, especially amides from the malt coombs, to supply the proteins of the milk.

Malt coombs therefore form an excellent food for milk yield. Compared with the mixed basal rations, meadow hay fed alone gave a considerable increase in the fat content of the milk.

Palm cake, in agreement with the results of other workers (C. KÜLM, V. KNIERIEM, v. LOCHOW, HANSEN, etc.) showed a specific effect in increasing the fat content of the milk.

Yeast added to the basal ration or to meadow hay alone also increased the fat content, but in a less degree than palmnut cake.

Vinasse had a specific effect in diminishing slightly the fat content.

Examination of all the results obtained shows that changes in the combination of rations and in the physiological condition of animals have resulted in differences in the utilisation of foods exceeding 100 per cent. Consequently, the determination of the relative milk yielding capacity of cows during one or several periods of lactation can only have a limited value.

BREEDING

628 – **Colour Inheritance in the Horse** (1). — WENTWORTH, E. N., in *Journal of the U.S. Cavalry Association*, Vol. XXV, No. 106, pp. 633-642. Fort Leavenworth, Kansas, April 1915.

The pigments of the equine coat.

A microscopic examination and simple chemical tests reveal only two pigments in the coat of the ordinary horse. These seem to correspond to the red or yellow and the black pigments found in rodents. Under the microscope red pigment grains may be discerned in the sorrel, chestnut, bay or red roan hairs. Besides the granules typical in form, there seems also to be a diffuse red, slightly lighter in tinge, distributed quite evenly throughout the cortical layer. This is evidently a basal ground pigment found in all but white or albino hairs.

The inheritance of the red pigment.

It has been shown that chestnut breeds true; the figures in the table, taken from various sources, show that out of 1610 matings all but 16 are chestnut, and it is very probable that this one per cent may be attributed to errors.

The black pigment seems more complicated in nature. In 406 individuals 41 are shown to be without it when black is mated to black, and 200 bear it to 108 without, when black is mated to chestnut. Since most of the individuals in the black by black matings are from the Percheron breed in which there are a large number of homozygous blacks the small ratio of chestnut segregates is not surprising. The 15 bays from the black by black mating are unexpected and probably represent errors in observation. The writer did not find any in his studies on actual individuals, some 100 in number.

The factors so far considered may be lettered as *c* for the chestnut ground pigment and *h* for the black pigment (HURST'S factor).

Bays and browns. Bay and brown are distinguished with difficulty and the writer groups such records together. Bay is a restriction factor that limits the development of the black pigment to the eye, mane, tail, lower limbs and the extremities in general. It can operate only in the presence of factor *h*, black pigment. Brown probably differs from bay in having the dapple pattern combined with the limiting factor *b*. This permits some black to appear where the dapples are located and gives a darker appearance. This idea would suit the microscopic as well as visual evidence since brown differs from bay in the presence of black hairs. Most writers have

(1) See also *B.* Jan. 1914, No. 44; *B.* Feb. 1914, No. 151; *B.* April 1914, No. 355; *B.* March 1915, No. 306. (*Ed.*).

considered brown dominant to bay, a condition which would suit the above theory since the dappling pattern is apparently dominant.

Bay to bay gives 5273 bay, 274 black and 672 chestnut. This varies quite a little from the expected 9:3:4 ratio. However, the bays are very largely (all but about 500), from the American Saddle Horse and Standard Bred records and bay has been the dominating colour among them for 75 years. The deficiency in blacks may be accounted for by their lack of popularity, which would prevent recording of black animals. Bay to black and to chestnut gives qualitatively similar results, as would be expected, but there is a lower percentage of bays and a higher percentage of blacks in one case and of chestnuts in the other than would be expected.

The high percentage of bays in the offspring of blacks to chestnuts has been non-conformable to previous theories. The restriction factor *b* does not appear somatically except in the presence of *h*, black pigment. Theoretically, three-fourths of the chestnuts ought to carry this restriction factor, so that the mating of these to blacks should always supply bays. From this standpoint there is a deficiency rather than an excess of bays.

The duns. Duns are little known. Their numbers are few and they may be grouped into at least three kinds. The ordinary buckskin with black extremities is probably a dilute bay, the yellowish dun a dilute chestnut, and the cream coloured with light mane and tail, a dilute sorrel with yellow extremities, (factor *m*) the dilution factor (factor *i*), is probably epistatic to all but gray and roan.

The grays. Gray is recognized as a separate factor by all writers. There seems some question as to whether it can operate in the absence of *h*, black pigment, but STURTEVANT presents evidence to show that it does. It is dominant to all factors previously named, dappling, *d*, and restriction, *b*, excepted, and varies from a deep iron gray in young stock to the white or fleabitten gray of the older animals. It is a simple factor since animals heterozygous for it produce fifty per cent grays and fifty per cent other colours, although experience indicates that gray is a unit in action, it seems possible that it must be a combination of dappling and the roan factor.

The roan pattern. Roan seems dominant to all other colours and is apparently a pattern entirely independent of the kind of pigment. Two kinds of roan exist visually, strawberry or red roan, and blue roan. These probably correspond to bays and blacks plus the roan pattern. It seems possible that there also exists a chestnut roan, in fact they are apparently quite common, for roans with red pigmented manes and tails instead of black are seen frequently. Such a roan would probably be the type produced by the mating of blue roan to blue roan in which the black factor was heterozygous. Roan differs from gray in lacking the dappling common to gray and in possessing quantitatively a much larger number of pigmented hairs.

Spotting. It varies in type, but it may receive at least two classifications, as stockings on the legs or as blazes on the face, and they seem to be inherited although they fluctuate very markedly in amount of white.

Another type of spotting is also recognised, namely saddle cloth marking. It is a spreading of white over the back, sides and croup and down

Colour inheritance in the horse.

	Coat colour of the offspring						
	Red roan	Blue roan	Gray	Dun	Bay	Black	Chestnut
Red roan × red roan	45	—	—	—	5	—	—
Red roan × blue roan	33	11	2	—	2	—	—
Red roan × gray	37	7	27	—	4	2	2
Red roan × bay	93	6	27	—	101	7	10
Red roan × black	14	4	1	—	5	11	1
Red roan × chestnut	18	2	4	—	12	2	4
Blue roan × blue roan	1	3	1	—	—	—	—
Blue roan × gray	—	—	1	—	2	—	—
Blue roan × bay	—	1	—	—	8	3	1
Blue roan × black	—	—	—	—	—	1	—
Blue roan × chestnut	—	1	—	—	1	—	—
Gray × gray	—	—	66	—	13	12	—
Gray × dun	—	—	7	5	2	—	—
Gray × bay	—	17	50	—	54	6	9
Gray × black	—	—	18	5	14	20	5
Gray × chestnut	—	—	14	—	7	2	10
Dun × dun	—	—	—	2	1	—	1
Dun × bay	17	—	—	4	4	1	1
Dun × black	—	—	—	3	1	1	1
Dun × chestnut	—	—	—	1	1	—	—
Bay × bay	—	—	—	—	5 273	274	672
Bay × black	—	—	—	—	1 218	476	130
Bay × chestnut	—	—	—	—	826	70	497
Black × black	—	—	—	—	157	391	41
ack × chestnut	—	—	—	—	135	65	108
Chestnut × chestnut	—	—	—	—	67	107	1 594

on to the legs. It is also inherited as a distinct unit although fluctuating in its limits, the absence of this character is recessive to its presence.

The reduction of pigment in mane and tail. — Yellow manes and tails on sorrels and cream coloured extremities on duns are very common. They are apparently recessive.

The dilution factor.—The numbers given in the following table show dilution to be a dominant factor.

Summary. — The factors and the composition of the colours are, according to the writer, as follows :

Factor *c* equals red or yellow basic pigment.
» *h* equals black.
» *b* » restriction factor producing bay in presence of *h*.
» *g* equals factor for gray pattern.
» *r* » » for roan pattern.
» *d* » » for dappling pattern.
» *s* » star or blaze in forehead and white on legs.
» *p* » piebald and skewbald markings.
» *m* » light creamy yellow mane and tail.
» *i* » dilution factor dominant to
» i_1 » intense.

Chestnut equals *c*, may have *b* and *m* in some cases.
Black equals *ch*, may have *d* in some cases.
Mouse equals *chi*, may have *d* in some cases.
Dun equals *c i*, *c b i* or *c m i* according to kind.
Bay equals *c h b*.
Brown equals *c*, *h*, *b*, *d*.
Gray equals commonly *c*, *h*, *g*, *d*, may be *c*, *g*, *d*.
Blue roan equals *c*, *h*, *r*.
Red roan *c*, *r* or *c*, *h*, *b*, *r*, latter commonest.

629 – **Olive Residues as Feeding Stuffs for Pigs.** — CUGNONI CESARE (Laboratory of Zootechny of the Royal Agricultural Institute of Perugia), in *Il Moderno Zooiatro*, Series V, Year IV, pp. 154-165. Bologna, April 30, 1915. PIGS

In Umbria winnowed olive residues have for long been in general use as food for pigs, but recently their use has gradually diminished owing to the following supposed disadvantages: 1) high cost for the effects obtained; 2) liability to deteriorate during storage either in storehouse or in silos; 3) tendency to produce dryness of the skin and roughness of the hair in pigs; 4) binding effect.

Considering the contradiction between the opinion of practical farmers and the favorable results of laboratory experiments, the writer was led to a new investigation of the question.

The raw residues are valued at 3.25 lire per quintal (1*s* 4*d* per cwt). and consist of pulp and skins and half kernels; consequently the pulp and skin (winnowed residues) cost 7 to 7.50 lire per quintal (2*s* 10*d* to 3*s* per cwt.) and even more when the olive crop is scanty. The exhausted residues, now consumed as fuel, are valued at 1l. per q. (5*d* per cwt.) and yield ⅓ pulp and skin and ²/₃ kernels, so that the pulp and skin is worth about 3 l. per q. (1*s* 3*d* per cwt.), the value of the kernels being about equal to the cost of labour. Though the feeding value is diminished, analysis shows that this reduction in value is not in proportion to the reduction in cost, and, further, the lower oil content renders this exhausted residue less liable to become rancid and thus cause constipation.

The experimental rations were prepared with: fresh or exhausted olive residues, bean (*Vicia faba*) meal, maize meal, potatoes, young lucerne and molasses. The composition of the first four foods was as follows:

	Fresh residues	Exhausted residues	Maize	Beans
Dry matter	89.98	85.71	87.06	82.14
Digestible constituents:				
Nitrogenous	5.36	5.69	5.41	23.90
N. free extract and fibre	35.95	35.38	65.80	45.10
Fat	9.98	1.70	4.35	0.73

Three groups of three pigs each were put on experimental rations for 80 days after a preliminary period of feeding. Group A, which served as a control, received bean and maize meal, potatoes and young lucerne; in groups B and C part of the maize meal was replaced by fresh and exhausted olive residues respectively, in such a proportion that the rations were almost equal either with respect to the quantity of the various principal food stuffs or to their total physiological energy value. During part of the experiment a little molasses was added to rations B and C, to render them more agreeable. The pigs always consumed their food readily.

The increases in weight in the three groups were as follows:

	Weight on August 4 lbs.	Weight on October 23 lbs.	Percentage increase
Group A.	292	583	199.4
» B.	297	581	195.6
» C.	290	571	196.6

The three rations were apparently of equal value, so that olive residues may effectively replace maize meal. During the experiment 258 lbs. of maize in group A were replaced by 326 lbs. of fresh olive residue in group B, and 364 lbs. of exhausted residue in group C. As the maize meal was purchased at 16 l. per ql. (6*s* 5*d* per cwt.) the value of the dried olive residue would be 12.60 l. per ql. (5*s* per cwt.)a nd that of the exhausted residue 11.30 l. per ql. (4*s* 6*d* per cwt.); but taking into account the value of the small quantities of molasses added, the value of the fresh olive residue (containing 23 per cent moisture) is about 10 l. per ql. (4*s* per cwt.) and that of the exhausted residues (containing about 25 per cent moisture) is about 8.50 l. per ql. (3*s* 6*d* per cwt.). Thus the exhausted residue is economically more advantageous in giving a greater increase of value in proportion to its cost.

The lack of success reported by some farmers can be attributed in many cases to the use of fresh residues fed with rations deficient in nitrogen. This disadvantage occurs to a less extent with exhausted residues which have a narrower albumincid ratio. The increase in roughness of the pigs was observed in a less degree among those fed with exhausted residues. The feeding of either fresh or exhausted residues had no disturbing effect on the digestive system.

630 – **The White Leghorn**. — HADLEY, PHILIP B. (Division of Animal Breeding and Pathology, Agricultural Experiment Station of the Rhode Island State College, Kingston R. I.), in the *Journal of Heredity*, Vol. VI, No. 4, pp. 147-151. Washington, D. C., April 1915. POULTRY

The White Leghorn is ordinarily a pure white bird without pattern or markings, the beak and shanks being yellow. No other pigment is manifested. The eye is ordinarily bay. The white plumage is a dominant white. So long as the White Leghorns are bred among themselves no other character appears. It is very different however when White Leghorns are mated with other breeds, as the following experiments of the writer show.

If a White Leghorn male is mated with a self coloured black like the Black Hamburg, Black Minorca, Black Spanish, or Black Langshan, the first generation progeny are commonly white. Close inspection however, will reveal in the feathers of most of the birds minute flecks of black. Sometimes these are large enough to amount to actual splashes, and occasionally one may find in the wing coverts or tail a feather which has several bars near the tip.

If now these F_1 birds are mated together, F_2 gives something of a variety of colors and markings. Among every 16 adult birds, 12 are white and 4 are dark coloured *i.e.* three are barred and one is black. Of the barred birds, two are males and one is a female. The one black individual in the sixteen is always a female. The barred pattern that appears in F_2 cannot come from the Black Hamburg grandparent since in every case where the factor for barring is added to black pigmentation the barred pattern is brought out. It must therefore have come from the White Leghorn which carries factors for this barred plumage pattern.

If a White Leghorn male is mated with a White Plymouth Rock or a White Silky female or with any other bird carrying recessive white, the first generation progeny are white, sometimes manifesting on close inspection a few black flecks. No coloured birds result. On mating these F_1 white fowls together one would expect nothing but whites. But this is not the case, among every 64 adult individuals there appear approximately 12 dark coloured birds, either barred or black, depending upon the cross used.

In the case of the White Plymouth Rock mating, introduction in F2 of black cannot be attributed to the White Plymouth Rock parent, because whenever a black factor is added to a recessive white carrying the barring factor, the pattern becomes patent and the bird becomes a Barred Rock or " Cuckoo ". One of two conclusions must be drawn : 1) either the White Leghorn parent contributed the black pigmentation or 2) the pigmentation was produced by the conjunction of two factors of which the White Leghorn and the White Plymouth Rock each contributed one. By Mendelian analysis of the experimental results this question can be answered: If one of these factors for black (x) comes from the Leghorn, and the other (y) from the White Plymouth Rock, then the number of dark coloured birds in F_2 is 9 in 64. If, on the other hand, the White Leghorn introduces all the factors necessary to determine black pigmentation in F_2 the number of dark coloured birds would be 12 in 64. In the actual experiments carried out

at the Rhode Island Agricultural Experiment Station among 167 F_2 birds raised from the mating in question, 33 were dark coloured and 134 were white. The expectation was dark coloured 31.2 white 135.8. It can therefore scarcely be doubted that the White Leghorn male carries in its germ cells all the factors necessary for the determination of black pigmentation in the F_2 generation of crosses with non pigmented breeds.

How are there facts explained? It has been stated that the White Leghorn possesses a dominant white. But white in the plumage of poultry is merely the absence of colour and this can scarcely be dominant over the presence of colour. It must be assumed therefore that the Leghorn white is due to some positive inhibiting factor (*I*) which in some way is able to repress or to neutralize the black pigment, not only in its own somatic cells, which would otherwise show black, but also in crosses with other black breeds. When *I* is present in a homozygous condition, black pigmentation is held completely in control; when *I* is present in a heterozygous condition, as in F_1 cross breeds, the effect is diminished and a little black frequently shows as minute flecks. This factor for the inhibition of black is apparently present normally in both male and female White Leghorns in homozygous condition and is not sex limited in its manner of inheritance. For the barring factor, however, the White Leghorn male appears to be homozygous and the female heterozygous.

The results of reciprocal crosses between White Leghorns and White Silkies show the existence of another inhibitive factor *I'* which acts (possibly in conjunction with the first inhibitor *I*) not only upon the black plumage pigment of ectodermal structure but also on the deeper mesodermal pigmentation in beak, shanks, and face. *I'* appears to be correlated with sex. It is transmitted from the male Leghorn to both male and female progeny, but by the female Leghorn it is given to the sons only. The White Leghorns also possess inhibitors for buff and red. Whether the factors that inhibit these colours are identical with the inhibitor of black cannot now be stated. Nor would it be safe to affirm that there are not still other unrecognized factors modifying pattern and plumage colour in this breed. And the fact that a study of the constitution of White Leghorns gives such new conceptions of their character complex, leads one to suppose that it is the same with other breeds of which little or nothing is known.

What the poultry world of today needs in addition to the Standard which tells how poultry ought to appear, is a Standard which will tell how the varieties ought to breed. It would be a great help to poultry breeders if each different breed should have its zygotic constitution represented by a formula designating, so far as possible, all the important characters possessed by that breed, thus indicating the breeding values. For instance, in the case of the White Leghorn the following symbols might be used to cover the characters already mentioned.

F = femaleness.
N = black pigmentation.
B = barring factor.
I = inhibiting factor No. 1.
I' = inhibiting factor No. 2.

and the constitution of the male written : $f_2\ N_2\ B_2\ I_2\ I'_2$; and the female : $Ff\ N_2\ Bb\ I_2\ I'i$.

Using these same symbols the White Dorking, another dominant white breed, but lacking the latent barring and black would become, male: $f_2\ n_2\ b_2\ I_2\ i'_2$; and the female : $Ff n_2\ b_2\ I\ i'_2$.

The White Plymouth Rock, a recessive white, which differs from the White Leghorn only in the lack of the factors for black pigmentation and for the inhibitors I and I' would be represented, male : $f_2\ n_2\ N_2\ i_2\ i'_2$; and the female : $Ff n_2\ b_2\ I_2\ i'_2$.

The White Silky with its black mesodermal pigmentation (M) would be, male : $f_2\ M_2\ n_2\ b_2\ i_2\ i'_2$; and the female : $Ff\ M_2\ n_2\ b_2\ i_2\ i'_2$.

631 – **Correlation between Egg-laying Activity and Yellow Pigment in the Domestic Fowl.** — I. BLAKESLEE, A. F. and WARNER, D. E., in *Science*, New Series, Vol. XLI, No. 1055, pp. 432--434. Garrison-on-Hudson, N. Y. March 1915. — II. BLAKESLEE, A. F. Fancy Points versus Utility, in the *Journal of Heredity*, Vol. VI, No 4, pp. 175-181 + 2 figs. Washington, D. C., April 1915.

In the Leghorns and the so-called American breeds such as the Plymouth Rocks, yellow in the form of yellow fat is present in varying amounts in the legs and beak. In these breeds, individual birds may undergo considerable change in the amount of the yellow pigment visible. The paling or yellowing of the legs has been attributed by poultrymen to various environmental factors. Of recent years, some poultrymen, however, have claimed that paling of the legs is due to the heavy laying, but the rules which judges in the showroom follow, as well as the common practice of poultry breeders, are opposed to a belief in any connection between laying and leg colour.

The results of observations made by the writers and collected in the two accompanying tables seem to show conclusively that a close connection does exist between the yellow pigmentation in a hen and her previous egg-laying activity, and that in Leghorns the colour of the ear-lobes is perhaps a better criterion of laying activity than either legs or beak and is more readily recorded.

The hens investigated took part in the egg-laying contest at Storrs, Conn., and were handled essentially alike, the influence of environmental factors, therefore, can be largely neglected. The amount of yellow was measured by means of the Milton Bradley colour top, the readings were taken at three different periods in October.

In Table I, the records at the three different readings have been used. With the exception of a few cases where this was not possible three records were taken of each bird. Since October is the season of decreasing egg production, the majority of the birds increased their quantum of yellow and consequently most birds are listed in more than a single colour grade. In the first line the number of hens observed for every class of colour is recorded. The second line gives the average number of days (for every class of colour) since laying. The third line gives the number of birds laying and the fourth the same number expressed as a percentage. Table I contains 932 records of 317 birds. Table II refers to 312 hens examined as to the

TABLE I. — *Percentage of hens laying and average number of days since laying for different amounts of yellow in ear lobes.*

Per cent. yellow	5-10	11-15	16-20	21-25	26-30	1-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
No. records	41	125	80	67	62	92	94	94	108	84	44	28	9	4
Average days since laying	0.4	1.6	7.3	17.1	26.2	37.9	41.5	44.0	45.1	51.3	55.9	61.4	50.3	71.0
No. records actual laying	36	98	44	17	3	0	1	0	2	0	0	0	0	0
Percentage of records actual laying	87.8	78.4	55.0	25.4	4.8	0	1.0	0	1.9	0	0	0	0	0

TABLE II. — *Average egg records for different amounts of yellow in ear-lobes.*

Per cent. yellow	5-10	11 15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
No. birds	7	36	40	16	20	31	33	41	39	30	13	4	1	1
September	19.7	18.2	16.9	16.4	10.3	5.5	6.1	4.9	4.0	3.6	2.4	1.3	0.0	0.0
October	15.3	14.2	11.7	8.1	3.2	0.5	0.2	0.2	0.2	0.1	0.0	0.3	0.0	0.0
Year	197.1	187.9	184.3	164.3	148.5	139.1	139.6	134.2	138.2	137.8	124.7	100.8	70.0	83.0

percentage of yellow in their ear-lobes on October 20. All the hens were White Leghorns.

From the first table it will be seen that the amount of yellow in the ear-lobes increases with the number of days since laying, and that it is practically certain that a bird with an ear-lobe showing more than 30 per cent yellow is not in a laying condition.

Table II shows that in general the egg production falls off as the percentage of yellow increases and that the correlation is more marked during the periods nearest the time when the records were taken.

A distinct correlation with colour seems to show in the yearly averages, but is a largely an indirect one. It is generally only the best birds that are laying in October. Therefore any method that selects the laying birds at this season will select at the same time the birds laying above average throughout the year. It seems that 30 per cent is a critical amount of yellow. Above this amount comes the sudden drop in egg production for the months of September and October, and also the yearly totals fall to between 130 and 140 with but slight change thereafter.

By the use of beak and leg colour similar results to those shown above have been worked out for breeds other than Leghorns.

The data presented indicate a connection between the amount of yellow pigment showing in a hen and her previous laying activity. The most natural assumption is that laying removes yellow pigment with the yolks more rapidly than it can be replaced by the normal metabolism, and in consequence the ear-lobes, the beak, and the legs become pale by this subtraction of pigment.

II. — It has been found that the yellow pigment in the ear-lobes, the beak and the legs of Leghorn pullets disappears when they begin to lay and returns when they cease laying.

The ear-lobe is apparently most quickly responsive, the beak next and the legs last. The yellower the ear-lobes, the beak and legs, the longer on the average since the last egg was laid.

The "Standard of Perfection" followed by judges in the show-room demands yellow in the beak and legs of the types of breeds recorded in Table I. This is in direct opposition to the interest of the practical poultry keeper. At the Storrs contest the hen which scored highest turned out to be the poorest layer in the pen, while the best layer was scored down because her beak appeared faded.

The writer therefore insists upon the necessity of modifying show standards, of taking greater accounts of yield and of giving less prominence to fancy points.

FARM ENGINEERING.

632 - **The Market for Agricultural Machines in Latin America.** — MARKS, ALFRED T. in *Farm Implement News*, Vol. XXXVI, N° 14, pp. 20-21. Chicago Ill. April, 8, 1915.

AGRICULTURAL MACHINERY AND IMPLEMENTS

The following is a brief review of the importations of agricultural machinery into the South American republics during the last few years.

Argentine. During the year ending June 30, 1914, this republi bought agricultural machines and implements to the total of $ 1 912 66 Of this amount the United States supplied $ 1 449 679 worth. For th preceding year the total importations were $ 5 571 733 and in the year befor they were $ 7 458 757. It is also worth noting that during the year endin June 30, 1914 Argentina bought of the United States $ 2 729 950 worth o binder twine.

Bolivia bought during 1914 farm machinery to the total of $ 239 55 of which amount $ 101 400 from the United States,

Brazil imported implements to the total of $ 308 642 in 1914, of whic $ 181 589 from the United States ; in 1913 the latter sold to Brazil farm machinery to the total of $ 290 000 and $ 493 000 in 1912.

Chile, in 1914, imported farm implements to the value of $ 1 095 856 Of this amount the United States supplied $ 590 406 worth, England $ 112 000 and Germany $ 83 450.

Columbia draws most of its agricultural machinery from the United States. In 1913 — no later figures being available — $ 141 700 out of a tota of $ 162 000.

Ecuador. In this republic the amount of arable land is small and agri- culture has not made much progress. What modern agricultural machines are used come mostly from the United States, with a small percentage from Great Britain.

Peru. Notwithstanding the fact that a good deal of its area is arid desert, mountainous or covered with tropical forest, agriculture takes the first rank among the industries of the country. In the larger cotton-grow- ing areas, especially, the ground is carefully prepared and steam traction engines, ploughs etc are in constant demand ; on the whole the market for agricultural machinery promises to become a rich one.

Uruguay. Although one of the smallest of South American Countries, this is one of the busiest and most progressive.

In 1914 Uruguay imported implements to the value of $ 401 550, the United States receiving $ 278 000 of this amount.

Venezuela. In 1914 this republic bought agricultural implements from the United States to the total of $ 81 364 ; from Great Britain $ 114 000 ; from Germany $ 21 000 and from the Netherlands $ 19 000.

633 – **Attachment for Ploughing in Green Manure.** — *Deutsche Landwirtschaftliche Presse* Year XLII, No. 32, pp. 290-291, Berlin, April 21, 1915.

The devices and appliances hitherto attached to ploughs, such as chains, disk coulters and rollers placed before the plough share have, for the most part, been unsuccessful in dealing with tall plants such as lupins and the like. Herr Walter Bohnstedt has now invented and patented in Germany under No. 263 622, an attachment which ensures the complete ploughing in of the tallest plants.

It consists of a U-shaped device *a* (figs. 1 and 2) open in front, and fast- ened in front of the plough share *b*. It is affixed to bar *c* attached hori- zontally and at right angles to the beam of the plough by a clamp which allows of its being shifted along the beam and also of being adjusted at

different heights from the ground. The land side of the U is fixed to the bar, the work side can be shifted by means of a clamp *e* so as to correspond

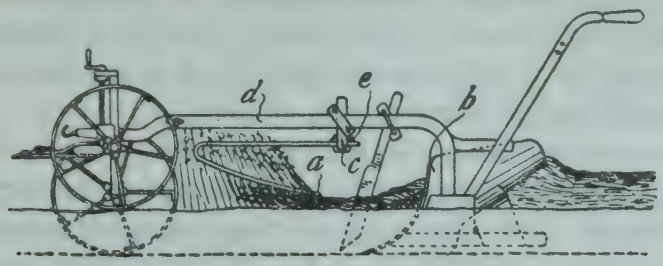


Fig. 1

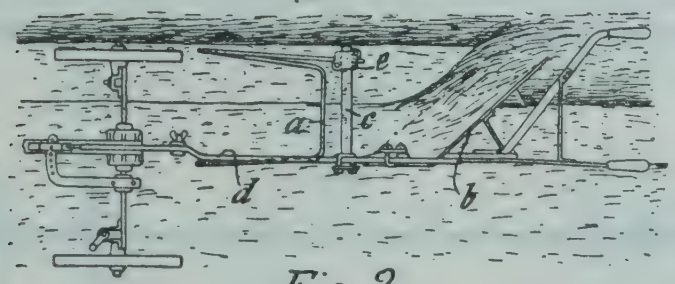


Fig. 2

Attachment for ploughing in green manure.

to the width of the furrow. The sides of the device act as dividers and the horizontal rod *a* presses the plants down and keeps them so until they are turned over and completely buried by the slice thrown up by the plough.

634 – **An Apparatus for Fumigating Seed.** — SASSCER, E. R., (Chief Inspector, Federal Horticultural Board) and HAWKINS, LON A. (Plant Physiologist, Plant Physiological and Fermentation Investigations), in *Bulletin of the U. S. Department of Agriculture*, N°. 186, pp. 1-6. Washington, February 27, 1915.

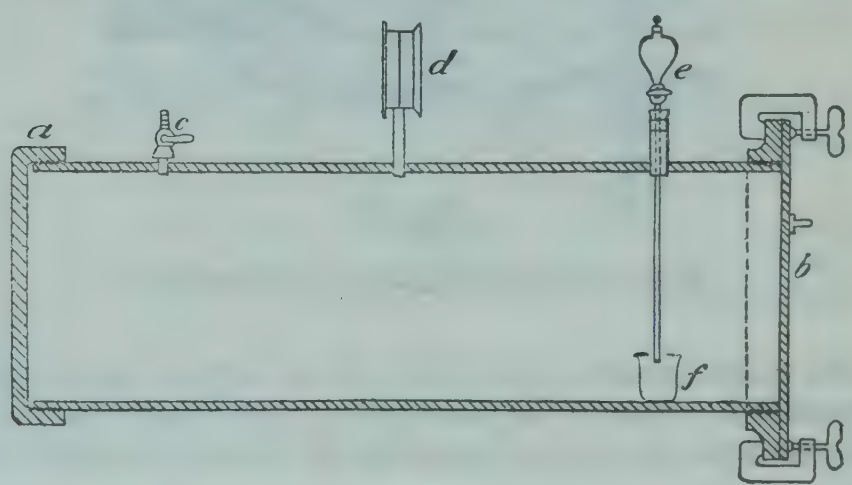
The ordinary methods of destroying insects in stored seeds such as subjecting them to dry or moist heat, carbon disulphide, and hydrocyanic acid in the presence of air have been found unsatisfactory for destroying insects in imported seeds.

It occurred to the writers to create a partial vacuum in the container in which the seeds had been placed and to fill the chamber with some gaseous insecticide, in the belief that a larger amount of gas might thus be forced into the crevices of the seeds and into the insect galleries than would be possible under normal atmospheric pressure. This method was successfully used with a number of different kinds of seeds and insects and the fumigation chamber described below was devised.

The fumigation chamber is of iron tubing 36 inches long by 12 inches in diameter. One of its ends is permanently closed with a heavy iron cap, (*a*). The other end is fitted with a flange and can be closed with a brass plate (*b*), which is held in place by clamps. A wide rubber gasket is placed between the flange and the plate. The chamber is designed to lie with its longest axis in a horizontal position. On its upper side three openings are made. The one near the capped end is fitted with a gas cock

(*c*), to which the suction hose of a vacuum pump can be attached. A vacuum gauge registering the pressure in inches of mercury is placed in the centre opening (*d*), and, in the third opening, a tubulature through which the tube of a dropping funnel passes nearly to the bottom of the chamber. An air pump, driven by a motor and capable of reducing the air pressure to about 0.05 of a millimetre of mercury, is used.

The seeds, contained in a cloth bag or open vessel, are placed in the chamber and the requisite amount of sodium or potassium cyanide in a small beaker (*f*) so arranged that the neck of the dropping funnel extends down into it. Then the cover is clamped on and the chamber exhausted to some fraction of an inch of mercury. The suction is then cut off and the required quantity of dilute acid previously placed in the bulb of the funnel is allowed



Apparatus for fumigating seed.

ed to flow slowly upon the cyanide. The hydrocyanic acid gas is thus prepared in the chamber and not a trace can escape. After the seeds have been exposed to the gas a sufficient time the stopcock of the funnel is opened and air admitted to the chamber. Air is then drawn through it by means of the pump to remove the poisonous gas, which is led out of the building by a pipe, before the cover is removed and the seeds taken out. In the experiments described here the seeds were carefully examined at several intervals to see whether all the insects were killed, and the seeds were tested as to their viability.

The summarized results of the experiment are given in a table and show that this apparatus is effective provided the exposure of the seed to the gas be sufficiently long, generally not less than half an hour, and that the seed is in nowise injured.

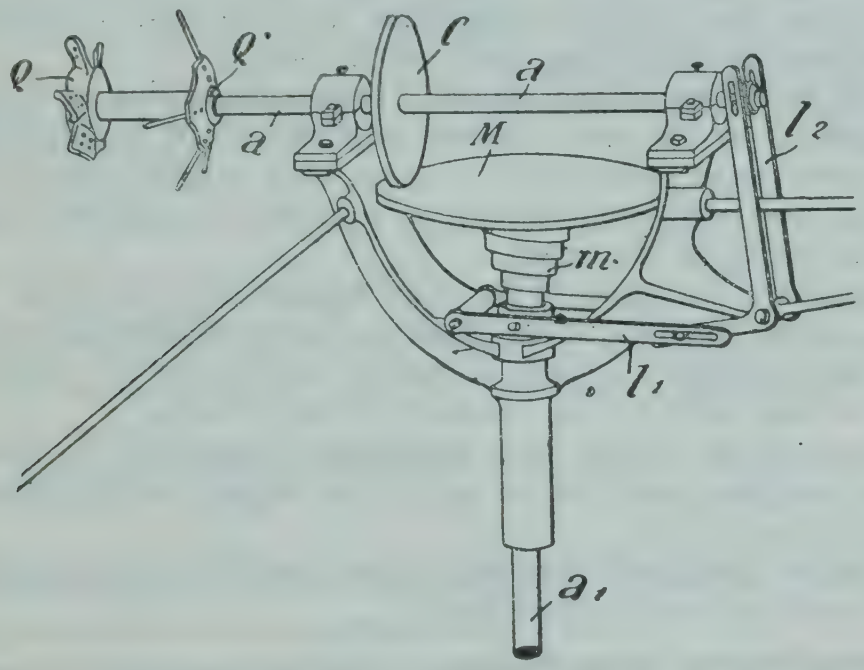
635 – **A Good Wind Engine.** — BRENCIAGLIA, EDOARDO, in *Società degli agricoltori italiani, Bollettino quindicinale*, Year XX, N° 6, pp. 179-186. Rome, March 31, 1915.

The serious drawbacks which prevent wind engines from being more generally adopted, notwithstanding the advantage of using a power which does not cost anything, are the following:

1. Wind engines do not act with light winds.
2. With high winds they either do not act or they become damaged.
3. They do not utilize fully the variable power of the wind.
4. They require considerable attention.
5. They are liable to be damaged by sudden gusts of wind and this in spite of the greatest care, thus causing expense for repairs and loss of time.
6. They must be stopped during the night, as a measure of precaution.
7. They must be frequently lubricated.
8. They are noisy.

In the Italian wind engine "Esperia" invented by Verney all these difficulties have been completely overcome in the following manner:

The power of the wind wheel the hub of which is shown in *Q* (see fig.)



Wind engine « Esperia ».

is not transmitted by means of spur-gearing but by two friction disks *C* and *M*. The rim of the smaller one is covered with leather which lasts some years and can easily be changed when necessary. The disks are pressed against each other by the coiled spring *m*. The absence of gears renders the working of the engine noiseless, and allows the disk *C* to skid over the other one when a sudden gust strikes the wheel. Thus no excessive and sudden strain can damage any part of the mechanism, in which friction is practically eliminated by means of ball bearings.

The automatic change in the ratio of transmission is the most interesting feature of the "Esperia". It solves the problem of proportioning the work of the pump to the power of the wind, thus utilizing both light and high winds. While with the common wind engines strong winds perform but little more than twice the work done by the lightest effective wind,

with the Esperia the maximum amount of work is ten times greater than the minimum, thanks to the automatic change of ratio.

When the wind is light the small disk *C* works near the outside edge of the disk M, where it is kept by the levers l_1 l_2, and the spring *m*. With an increase in the velocity of the wind, its pressure on the wind wheel increases also and it forces the latter together with the disk *C* to shift backwards, causing the disk *M* to revolve more rapidly and drive the pump faster, at the same time the greater compression of the spring increases the friction and the grip between the disks. In this manner the pump attains its full potentiality with a certain wind velocity, while the usual wind-driven pumps are worked much below their capacity in order to guard against the disastrous increases of velocity due to sudden gusts of wind.

If the wind continues to increase in violence the wind wheel assumes an oblique position, the pressure diminishes, and the disk *C* approaches its former position and limits the speed of the pump.

The sails or blades of the "Esperia" besides possessing all the improvements suggested by the most recent experiments in aerodynamics, are curved at their outer extremity so as to offer greater concavity to the wind. They are comparatively few in number, but set wide apart and reach to the centre of the wheel.

For regulating the speed of the wind wheel in the "Esperia" no brake is required, as the skidding of the disks in squally weather affords effective safety, so that a double tail vane or rudder can be adopted, which obliges the wheel to face fully all but excessively high winds.

The bearings are fitted with automatic lubricators so constructed that they do not lose a drop of oil and do not require to be refilled oftener than twice a year.

The friction disks and automatic speed regulator are efficiently protected by a solid galvanised iron cap.

636 – **Exhibition Trial of Potato Planters.** — *The Implement and Machinery Review*, Vol. 40, Nos. 480 and 481, pp. 1514-1515 and 73-74. London, April 1, and May 1, 1915.

An exhibition trial of potato planters was conducted on March 25 of this year by the Highland and Agricultural Society of Scotland. Five planters and one dibbler took part in the trial. No prizes were offered, but an official report was published, a summary of which is given below.

The machines had to work on sloping drills 250 yards in length, the double planters being tested on 24 drills with ordinary 1¼ inch round seed whilst the single machines did the same work on 12 drills.

The competing machines were the following :

1. The "Richmond" two row potato planter built by Messrs. Wallace of Glasgow. In this machine an endless chain of cups raises the potatoes out of a hopper and drops them into a tube which delivers them into the drill at any desired distance apart between 8 and 18 inches; the shafts are movable so that the horse can walk either on the top or in the bottom of the drill as desired. With this machine, which costs £15 15*s*, from 7 to 8 acres a day can be planted.

2. The "Richmond" one-row potato planter by the same makers as No. 1, and on the same principle, but fitted with an artificial manure distributing attachment. This machine costs £15.

3. A double row planter constructed by Messrs. J. Bisset and Sons, Ltd. of Blairgowrie. The seeds are lifted from the hoppers by cups attached to revolving chains and dropped at 11, 13 or 15 inches intervals This machine costs £15 and can plant 7 to 8 acres a day.

4. The "Eureka" No. 8, built by the Eureka Mower Co. of Utica N. Y. It is a one-row machine with fertilizer attachment and is priced at £12 12s. A plough under the axle opens the drill, while disks ensure proper covering on hill sides and uneven ground. The depth of planting can also be regulated.

5. A double row potato planter, price £16, entered by A. Hunter of Maybole, Perthshire. In this machine the potatoes are carried from the hopper by two rotary disks having movable tongues, which, being operated by weights and stationary cams, release the potatoes at the top of two shoots down which they fall, the impetus of the falling potatoes being taken up by swinging flaps controlled by weights. These flaps also regulate the discharge.

6. A dibbler shown by Mr. H. Davies of Southport, Lancashire; this holes two drills at a time by means of two spades at the sides of the machine which are kept in a vertical position by parallel rocking bars driven by side tappets. These latter engage roller bolts set alternately in the driving wheel in the centre. The holes are made 10 to 18 in. apart and of any required depth, and the machine covers up the seed when planted. It costs £15.

The "Report by Official Observers" on the above machines is as follows:

The work of No. 1. the "Richmond", was on the whole very satisfactory, even with long-shaped and cut seed it was beyond the expectations of the official observers and the arrangement by which the shafts are movable was considered to be a decided advantage.

The work of No. 2, the single row "Richmond" appeared as near perfection as is possible by mechanical means.

Machine No. 3. worked fairly well but the distribution of the seed was rather faulty in places.

Machine No. 4. the "Eureka" seemed to distribute the seed regularly; the general design of the machine is ingenious but doubt was entertained as to its strength and stability for ordinary farm work.

Machine No. 5, was considered to be still in the experimental stage. It possesses many good features and the principle on which it is constructed appears to be good, but in the meantime its work left much to be desired.

The dibbler No. 6. which makes holes in which the seed is placed by hand, did not work very satisfactorily, the condition of the soil also was not favourable.

The Committee were unanimously of opinion that the work done by machines 1 and 2, especially the latter, was the best. They further consider that it is desirable to have the machines adjustable to varying widths

of drills, and that in no case was the work done with cut seed so satisfactory as that with whole potatoes.

637 – Review of Patents.

Tillage Machines.

Austria	69 017. Anchor chariot for machine ploughs on the one engine system.
Canada	160 148. Cultivator.
Germany	281 919. Apparatus for loosening the soil behind the hoes of hoeing machines.
	2 820 018. Device for lifting and lowering a supporting wheel borne by a vertical shaft on ploughs.
	282 120. Protecting device for the rack and pinion used for regulating the height of the frame of motor ploughs.
	282 142. Hoeing machine.
	282 174. Bearing of supporting wheel for motor ploughs with adjustable frame and steering disk in separate bearing.
Italy	146 586. Two share auto plough.
	146 837. Ploughing or excavating machine driven by combined mechanical and animal power.
	146 838. Motor trench digger.
United Kingdom	27 051. Beam for spring teeth in cultivators.
	28 078. Harrow.
	28 081. Ridging plough.
	28 782 — 28 783. Spade and like handles.
United States	1 129 869. Scraper for furrow openers.
	1 129 926 — 1 129 971 — 1 130 524 — 1 130 714. Ploughs.
	1 130 655. Subsoil plough or cultivator.
	1 130 364. Implement holder for tilling machines.
	1 131 566. Harrow.
	1 130 887 — 1 130 924 — 1 131 110 — 1 131 303 — 1 131 957 — 1 132 842 — 1 131 957 — 1 132 842 — 1 133 140. Cultivators.
	1 130 963. Orchard furrower.
	1 131 238. Reversible disk harrow.
	1 131 245. Garden plough.
	1 131 480. Double row cultivator..
	1 132 654. Land roller.
	1 131 907. Stalk cutter.
	1 132 543. — 1 132 656 — 1 133 553. Cotton choppers.
	1 132 563. Harrow attachment for ploughs.
	1 132 832. Lister.
	1 133 211. Plough share.
	1 133 221. Cultivator tooth.
	1 133 558. Setting device for sulky ploughs.
	1 133 956. Tilling machine.

Manure distributors.

Germany	282 175. Artificial manure spreader.
United States	1 132 053. Fertilizer spreader.

Drills and sowing machines.

Austria	69 001. Drill with press rollers.
Germany	281 880. Fastening for shoe levers in drills.
	281 881. Potato planter with furrow-openers, press rollers, etc.

281 903. Drill in which the quantity of seed sown is regulated by changing the speed of the feeding shaft.
282 040. Drill with one feeding wheel for all kinds of seeds.
282 259. Dibbling attachment for drills.
282 361. Potato planter.

United States. 1 129 962. Seed sower.
1 131 013. Planter.
1 131 014. Elevating mechanism for corn planters.
1 131 245. Cotton planter.
1 132 401. Combined planter and fertilizer.
1 133 351. Seed-drill.
1 133 498. Two-row planter.

Reapers, mowers and other harvesting machines.

Canada. 160 252. Binder twine cutter,

Germany 282 042. Fore-carriage for mowers.
282 388. Conveyors for binders consisting of blind-like metal strips mounted on an endless chain.
282 468. Mower with endless cutting ribbon.

Switzerland 69 121. Pedal brake for mowers and the like.

United Kingdom 29 541. Harvesting, threshing, dressing, bagging and straw binding machine.

United States 1 130 330 — 1 133 219. Guard finger for mowers and reapers.
1 130 737 — 1 130 799 — 1 131 171. Shocking machines.
1 130 757. Attachment to binders.
1 131 022 — 1 131 586. Corn harvesters.
1 131 800. Corn picking and husking machine.
1 131 804. Cotton picker.
1 132 102. Cotton harvester.
1 132 857. Shocking accessory for harvesting machines.
1 133 085. Mowing machine.
1 133 422. Harvester.
1 133 736 — 1 133 817. Corn husking machines

Machines for lifting root crops.

Denmark 20 002. Elevating appliance for root lifting machines.
20 047. Machine for lifting and topping turnips and kohbrabi.

Germany 282 041 — 282 043. Potato lifters.
282 113. Revolving truncated conical screen drum for potato lifters.

United Kingdom 29 737. Potato digger and grader.

United States 1 129 939 — 1 133 908. Potato diggers.
1 131 465. Potato gatherer.
1 132 149. Beet harvester.

Threshing and winnowing machines.

Germany 282 020. Threshing machine with awn-removing apparatus.

United States 1 132 731. Self feeder for threshing machines.
1 133 970. Beater for threshers.

Machines and implements for the preparation and storage of grain, fodder, etc.

Austria 69 019. Machine for binding straw.

Canada 160 153. Grain bagger.

Italy 145 626. Apparatus for the hydraulic selection of seed.

Switzerland 69 123. Device for the drying of grass and the like.
United Kingdom 27 842. Apparatus for drying tea, coffee, grain, etc.
28 136. Apparatus for cleaning and separating seeds, grain, meal etc.
28 375. Feeding mechanism for chaff cutters.
28 438. Apparatus for cracking shells of cohune nuts, etc.
29 084. Machine for pulping coffee.
29 659. Hay loaders.
United States 1 129 992. Self-feeder for ensilage cutters.
1 130 006 — 1 130 780 — 1 132 131. Baling presses.
1 130 958. Concrete silo.
1 132 083. Hay-baler.
1 133 048. Baling machine.

Dairying machines and implements.

Denmark 20 020. Cream separator.
20 040. Milking machine.
Germany 282 045. Milk heater and cooler with outside heating and single agitator for heater and recuperation of heat.
282 046 — 282 258. Butter moulders.
United States 1 132 639. Milking machine.

Other agricultural machines and implements.

Canada 159 953. Incubator.
160 123. Cheese box.
160 151. Collapsible basket.
160 246. Vegetable parer.
Denmark 19 950. Device for rapidly freeing animals in stables.
20 016. File for horses' teeth.
France 474 616. Process and apparatus for employing liquid insecticides at any desired temperature without the use of boilers.
Germany 282 044. Machine for picking and cleaning hops.
282 143. Clean cutting fruit tree shears.
228 208. Key Cottar for fastening the bolts of cleats on the tires of agricultural machines.
282 289. Apparatus for separating round and flat bodies by means of inclined conveyor belts.
282 390. Tree felling apparatus with vertical stand and movable arm.
282 429. V-shaped cleats for the driving wheels of agricultural machines, especially of motor ploughs.
282 430. Fastening for cleats, sections of tires, etc., on the wheels of motor vehicles, especially of agricultural machines.
282 447. Apparatus for breeding silkworms.
Italy 145 340. Apparatus for steaming wine casks and the like.
145 561. Piston pump for deep wells.
145 604. Universal grape crusher with suction apparatus.
146 031. Wooden crate for the transport of grapes by rail and otherwise.
Switzerland 68 933. Apparatus for catching field mice and moles.
69 124. Electrical incubator.
United Kingdom 27 503. Collapsible poultry coops.
27 897. Poultry house.
27 994. Chambers for expressing liquids, oils, juices, etc.
28 275. Apparatus for distributing powders on crops.

28 553. Feeding appliance for poultry.
28 938. Machine for cleaning and masticating rubber.
28 992. Machine for cutting food for poultry, dogs, etc.
29 764. Improvement in gearing of traction engines.
30 022. Machine for removing pericarp from fruit, palmnuts, seeds, etc.

United States 1 113 758 — 1 130 117 — 1 132 139. Traction engines.
1 129 997. Draught equalizer.
1 130 018 — 1 130 285 — 1 131 394 — 1 132 363. Tractors
1 130 311. Hitching device for traction engines.
1 131 288. Steering mechanism for traction machines.
1 131 414. Automatic feeder for mills, crushers, shredders and the like.
1 133 039. Grasshopper-destroyer.
1 133 589. Machine for holding sickle-bars while being sharpened.
1 133 595. Windmill.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS.

638 – **The Influence of the Clarification of Wines on their Chemical Composition.** — La Marca, Ferdinando, in *Le stazioni Sperimentali Agrarie Italiane*, Vol. XLVIII, Part 3, pp. 185-232. Modena, 1915.

Experiments were carried out with nine types of Italian wines of different qualities and chemical composition, and comparisons were made between them with the various clarifying agents, such as: fish glue, gelatine, milk and its derivatives, white of egg, blood, aluminous earth and charcoal. The official methods of analysis were adopted and the numerical data of the variations in the contents of extract, tannin ash and nitrogen were tabulated.

The writer's conclusions are as follows:

1. Clarifying by means of fish-glue modifies the composition of the wine, diminishing the extract and the tannin, but has no influence on the organoleptic properties. This may be considered as the best clarifying agent.

2. Gelatine diminishes extract, tannin and ash and even the nitrogenous matter to a slight extent. The organoleptic characters are also slightly changed.

3. Milk produces an increase in extract and ash, a decrease in tannin and colouring matter and a slight increase in nitrogenous matter. The organoleptic characters are markedly altered. Milk serum is a very poor clarifying agent, whilst casein gives fairly good results when well prepared and especially when well preserved.

4. Egg-albumen does not noticeably alter the chemical composition and has no effect on the organoleptic characters of the wine. It is certainly one of the best clarifiers.

5. Blood is a good clarifying agent, but changes slightly the aroma, flavour and colour of the wine. It appreciably diminishes the tannin and to a slight extent the extract, ash and nitrogen.

6. Aluminous earth decreases the extract, but not the tannin or the intensity of colour; it also produces a notable reduction in the percentage of acid. Kaolin has less influence than Spanish earth.

7. Charcoal diminishes the extract and especially the acidity; the tannin is also slightly diminished, whilst the ash and nitrogenous substances are almost unchanged. Owing to decolorisation effects there is no true relation between the reduction of colour and the quantity of material employed.

639 – **Determination of Saccharose in Frosted Sugar-Beets.** — SAILLARD, ÉMILE, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 15, No. 12, pp. 360-363. Paris, March 22, 1915.

The writer analysed samples of sugar-beets which had been submitted to a sharp frost (of — 10° C, = 18° F) and had then thawed; they smelt of alcohol and many of them gave off gas and a gummy liquid.

The juice of these beets was 10 times as acid as that from normal beets, and this acidity increased on storing, whilst the viscosity of the juice diminished as if the gummy substance had undergone partial hydrolysis by means of the acid. Analysis showed that: 1) While at the time of lifting the roots contained 15 to 16 per cent of sugar, after freezing they showed 1 to 5.1 per cent of reducing sugar before inversion, 5.26 to 12.82 per cent of saccharose estimated chemically and 4.96 to 12.32 per cent by the optical method; this shows that on thawing a large part of the original sugar had disappeared by viscous fermentation. 2) Affected sugar-beets showing the most reducing sugar also contain the least saccharose. 3) The chemical method of determining saccharose gave higher results than the CLERGET optical method, whilst in the case of normal healthy beets the two methods give the same numbers. The writer therefore investigated the value of the method of inversion by diastase at 50 to 55° C., as used by OGILVIE to determine the sugar in molasses.

With sound beets the diastatic method gives results equal to those of the method of hydrochloric acid inversion at 69° C., and also those of the chemical and optical methods. With thawed beets hydrochloric inversion gives a higher percentage of saccharose than the diastatic inversion, and a higher result by the chemical than by the optical method; diastatic inversion on the contrary, gives equal results by the two methods. Diastatic inversion, therefore gives the most exact determination of the saccharose in the juice.

It is therefore concluded that sugar-beets after freezing contain some body or bodies hydrolysable by hydrochloric acid and unaffected by sucrase and consequently different from saccharose. These reducing sugars, derived from polyoses other than saccharose, are fermentable.

The experiment was made with juice extracted in the cold, freed from pulp, and acidified with sulphuric acid. After prolonged fermentation the healthy juice gave a yield of alcohol equivalent to the sugar destroyed. In the same way, the juice of frozen beets showed the same amount of reducing sugar before and after diastatic inversion, but a greater quantity after hydrochloric acid inversion; further, the yield of alcohol exceeded that corresponding to the saccharose and reducing sugars originally in the sap. Also, the experiment shows that the hydrolysable substances other than saccharose contained in frozen beets can be transformed into reducing sugars, not only by hydrochloric acid at 69° C., but also by the same acid in the cold and by

acetic and tartaric acid at 30° C. It must be concluded that the alcohol produced by the fermentation of frozen beets is partly derived from hydrolysable substances other than saccharose, which are not changed by invertase, but which are susceptible of slow transformation into fermentable reducing sugars under the influence of the acids contained in the juice at a temperature of 28 to 30° C. Thus, after certain changes, frozen sugar-beets are more suitable for distilling than for sugar extraction.

640 – **Corn (Maize) Products Industries in the United States.** — BERFORD, E. T. (President of the Corn Products Refining Company): Communication read before the 50th Congress of the American Chemical Society, New Orleans, March 31-April 3, 1915, in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 4, pp. 275-276. Easton, Pa., April 1915.

The following figures show the great development of maize products industries in the Unites States.

Maize crop . . . . . 50 000 000 bushels

Products	Million lb.
Corn Syrup	800
Starch	600
Corn Sugar	230
Gluten feed	625
Oil	75
Feeding Cakes	90

In addition there are several sub-products *viz*: maize bran; solid residues from the maceration water containing nitrogenous substances, sugars and other carbohydrates, organic phosphorus compounds and salts of magnesium and potassium; glycerine and fatty acids; soaps; dextrine and gums. There is also a tendency to produce numerous food products formerly used for industrial purposes, notably glucose, now considered an ideal food; also gluten, formerly used as food for live stock.

The progress in the mode of preparation enables the maize products to compete with those of wheat, potato, sago, rice, etc., the products of which are limited to starch, and liquid and solid glucose.

641 – **The Cotton Seed Oil Industry in the United States.** — WESSON, D. (Manager of the Technical Department, Southern Cotton Oil Company): Communication read before the 50th Congress of the American Chemical Society New Orleans, March 31-April 3, 1915, in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 4, pp. 276-277. Easton, Pa., April 1915.

The cotton seed oil industry, which began in the United States about the middle of the 19th century, had only consumed 4 per cent of the entire seed crop in 1872, whilst in 1913 out of a production of 6 305 000 tons of cotton seed, 4 762 800 (or 75.6 per cent) were crushed for the extraction of oil. At an average price of $ 25.35 per ton, the total value of seed was $ 120 840 000, whilst the value of the products (oil, cakes, and meal used as forage) was $ 156 000 000.

The progress of this industry from a chemical standpoint has enabled the preparation of almost all the oil as a food product and, at the same time, useful by-products (cakes, cotton seed, meal, and hulls for forage) are obtained. Further, the process of the hydrogenation of oils makes possible the production of solid fats suitable for food.

In addition to the industrial advantages, the cotton seeds benefit North American Agriculture to the extent of $ 125 000 000 per annum, equivalent to an increased profit of $ 10 to $ 12 per bale of cotton (1).

642 - **Chemically Pure Rubber**: I. **Preparation and Chemical Properties.** — HEIM, F., and MARQUIS, R., in *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 8, No. 86 pp. 101-108. Melun, February 1915.

It is of practical interest to obtain a chemically pure rubber to serve as a standard for the comparative technological study of different rubbers. The writers have produced pure rubber from wild Para rubber from the Amazons coagulated by smoke, and from plantation Para rubber from Indo-China coagulated by acetic acid. They have not yet determined whether pure rubbers of different botanical origin have identical properties.

The method of preparation is as follows: maceration followed by washing in cold water in a tube covered with black paper; washing with acetone; evaporation of the acetone on filter paper; dissolving in ether or benzol; filtration through a Buchner porcelain filter; precipitation with alcohol or acetone; digestion with alcohol (to eliminate traces of benzol); drying over sulphuric acid in the dark.

Prepared thus, caoutchouc from unsmoked rubber is perfectly white, whilst that from rubber coagulated by smoke is slightly yellow; the two are, however, of equal chemical purity, for the coloration is due to small quantities of impurities too small to be measured. The pure caoutchouc was free from resin and proteins, and elementary analysis showed a constitution corresponding to the formula of a polymer of isoprene $(C_5 H_8)n$. It behaves towards solvents like impure caoutchouc, except that its solutions are less viscous. Its chemical properties are also similar to these of impure rubber, except that some of them are more pronounced; thus it oxidises more readily in the air, especially when dissolved in chloroform.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

643 - **Ability of *Bacillus coli* to Survive Pasteurisation.** (2) — AYERS, S. H., and JOHNSON, W. T., jr., in *Journal of Agricultural Research*, Vol. III, No. 5, pp. 401-410. Washington, February 1915.

The presence of *Bacillus coli* in pasteurised milk is generally interpreted as an indication of insufficient heating or of fresh contamination owing to carelessness after pasteurisation. This interpretation is based on the low thermal death point of the bacillus. Several workers have studied cultures during recent years and have stated that this organism was easily destroyed at temperatures below 60° C. Sometimes, however, it has happen-

(1) See *The International Movement of Feeding Stuffs* No. 1. *B.* April, 1915 pp. 492-493 (United States). (*Ed.*)

(2) See also *B.* Dec. 1914, No. 1173. (*Ed.*)

ed that much higher temperatures (*e. g.* 30 minutes at 70°-72°) were necessary to destroy the organism. With a view to determining with more exactness the fatal temperature for *B. coli* and its relation to the temperatures of pasteurisation, the writers carried out the following researches.

The fatal temperature for 174 cultures of *B. coli* isolated from the faeces, milk and cream of cows, from human faeces, flies and cheese, showed considerable variations when the cultures were heated in milk for 30 minutes under conditions identical with those of pasteurisation. At 60° C., the lowest temperature of pasteurisation, 95 cultures or 54.6 per cent survived; at 62.8° C., the ordinary temperature of pasteurisation, only 12 or 6.9 per cent survived. One culture was not destroyed at 65.6° C., on first heating, but succumbed when reheated several times. There is a marked difference in effect of heating to 60° C., and to 62.8° C., 87.3 per cent of the cultures which survived at 60° C. being destroyed at 62.8° C. There were considerable variations in the fatal temperature of the bacilli which survived at 62.8° C.; on re-heating to the same temperature the twelve cultures which survived, several succumbed, and with each re-heating different results were obtained. It appears that a temperature of 62.8° C. maintained during 30 minutes is the critical temperature for *B. coli*. It was found that in all the 174 cultures studied, the thermal death point for the majority of the individual bacilli was low, but the cultures were able to survive pasteurisation owing to the resistance of a small number of individuals.

The use of *B. coli* as a test of the efficacy of pasteurisation is complicated by the ability of certain strains to survive heating to 62.8° for 30 minutes and to develop rapidly when the pasteurised milk is maintained under ordinary conditions of temperature. The presence of a large number of *B. coli* immediately after heating may indicate defective treatment of the milk. If the milk is pasteurised for 30 minutes at 65.6° or more, it may be assumed on the strength of these experiments that none of the bacilli will survive. Under these conditions the *B. coli* test may be used to control the efficiency of pasteurisation. It is possible, however, that the study of a greater number of cultures would reveal the presence of strains of *B. coli* capable of surviving this or even higher temperatures.

644 - **Hot-Water Heating in the Manufacture of Cheese.** — Fascetti, G., in *L'Italia Agricola*, Year 52, No. 3, pp. 117-118. Piacenza, March 15, 1915.

Amongst the most important innovations introduced into small cheese factories, is the substitution of steam heating in place of direct heating; but certain practical difficulties in this connection have necessitated the application of the circulation of superheated water. Already this principle is in use in certain cheese factories in Emilia (Italy), to the satisfaction of technical experts.

The apparatus consists of a small boiler adapted for wood or coal, and a jacketed heater for the cheese. The two are connected by means of a system of pipes provided with steam drums for regulating the pressure, which determines the circulation of the superheated water. When the heated water has attained the temperature of 105° C. it passes into the jacket

of the cheese heater, and returns to the pipes at a lower temperature. A system of taps is arranged so as to interrupt the circulation as soon as the working of the cheese is completed.

Several months' experience has shown that the necessary expenses are reduced to 5*d* or 6*d* per 100 gallons of milk dealt with, and that the process can be accelerated when desired; heating by direct fire involves an expenditure of 1*s* 8*d* to 2*s* per 100 gallons of milk.

The hot-water installation does not require a special building; it can be put up in any cheese dairy and carried easily from one dairy to another.

645 – **The Use of *Bacillus bulgaricus* in Starters for Making Swiss or Emmental Cheese.** — DOANE, C. F., and ELDRIDGE, E. E., *Bulletin of the U. S. Department of Agriculture, No.* 148, *Contribution from the Bureau of Animal Industry*. Washington, D. C., March 22, 1915.

Some difficulty has been experienced in the manufacture of Emmental cheese in the United States, more especially during the winter months, owing to the development in the cheeses of undesirable gas-producing organisms which prevent uniformity in the formation of the eyes. In order to check the growth of such undesirable organisms, experimental cheeses were made in various parts of the United States, using cultures of *Bacillus bulgaricus* as a starter and maintaining a high temperature during scalding and pressing. Under these conditions, the *bulgaricus* suppressed the action of the gas-forming organisms and normal cheeses were obtained.

Many cultures of *bulgaricus* were tried and their ability to suppress undesirable fermentations was found to vary widely with different strains. Several were able to prevent gas formation when the starter was less than 2 per cent of the total milk used, others did not prove efficient with less than 4 per cent. Ordinary lactic acid cultures were also tried, but proved quite inefficient in preventing gas formation.

The application of the use of *bulgaricus* as a starter was also tested in a cheese factory under commercial conditions. Good cheese was made at a season when it was not possible to make marketable Swiss cheese in ordinary practice. Evidence was also obtained to show that, with the use of *bulgaricus* cultures, Emmental can be made from milk twelve hours old, so that it becomes possible to make the cheeses only once a day instead of twice as has hitherto been necessary.

646 – **Researches into the Purification of Waste Water from Dairies.** — WEIGMANN and WOLFF, A., in *Milchwirtschaftliches Zentralblatt*, Year 44, Part 4, pp. 49-60; Part 5, pp. 65-73. Hanover, February 15 and March 1, 1915.

The following conclusions are drawn from researches on the practicability of the various methods of purifying waste water most commonly used in dairies.

The purification of waste water from dairies with the assistance of biological action on filter-beds may be called quite a good method as far as the removal of substances liable to putrefaction is concerned, for by this means about 70 per cent of the albuminous substances and some 85 per cent of the easily oxidised matters are removed. It is, however, not by any means complete, for the waste water still has a strong smell of putre-

faction and requires subsequent aeration. If this is impossible, however, the water can be sufficiently cleansed to satisfy all requirements by spraying it into the air after it leaves the filter-beds and then allowing it to pass through a sand filter. Purifying by irrigation can naturally not equal this method in completeness.

2. Clarifying with lime-water is insufficient and such a preliminary purifying in no wise increases the efficacy of biological action.

3. Equally insufficient is the purification of waste water by means of colloidal clay and lime-water, and a preliminary treatment with these substances is useless. These methods are scarcely as good as the lime-purifying process and have the disadvantage of not leaving the water clear. Colloidal clay must therefore be omitted from the substances that can be used for the purification or clarification of waste water.

4. A considerable clarifying effect must, however, be attributed to ferric sulphate, and its use should be especially efficacious in the case of waste dairy water, for this contains its albuminous matter in a colloidal condition. In the writers' experiments, 65 per cent of the total albumen was decomposed. Used in the preliminary treatment, ferric sulphate increases very considerably the biological purification. The use of this compound is therefore to be recommended where bacterial action alone proves to be insufficient.

The agricultural value of the sludge is certainly questionable.

647 – **Modifications in the Blood of Cattle Due to the Method of Slaughter.** — SQUADRINI, GIULIO, in *Il Moderno Zooiatro*, Year 4, No. 2, pp. 51-56. Bologna, February 28, 1915.

The writer has attempted to ascertain experimentally the effect which the different methods of slaughter have upon the alteration of the blood of cattle. The animals were slaughtered by shooting with a Stahel pistol, by a blow from a club on the forehead, by severing the veins of the neck and by cutting the medulla oblongata between the atlas vertebra and the skull. The observations were directed to : 1) the time elapsing between the death-blow and the taking of the blood ; 2) the time taken by the blood to coagulate ; 3) the amount of blood serum produced after 24 hours' coagulation ; 4) the surrounding temperature. The observations were made in summer and winter.

They showed that shooting accelerates the coagulation of the blood to such a degree that it becomes almost instantaneous ; the rapidity was the greater the less the time elapsing between shooting and the bleeding. If the time between death and bleeding was very considerable (3 or 4 minutes), coagulation was delayed. The writer concludes that in this case the general law of a retardation (negative phase) following an acceleration comes into play. The amount of fibrin in the blood was unchanged, but the fibrin appeared to be not quite normally constituted.

The other methods of slaughter had no abnormal effect upon the coagulation of the blood. The writer has so far been unable to account for the remarkable effect of shooting the animals with a pistol, and intends to make further experiments in this direction.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

648 – **Damage Caused by Hail to Wheat, Barley, Oats and Rye.** — SCHANDER, R., in *Fühling's Landwirtschaftliche Zeitung*, Year '63, Part 21-22, pp. 657-703, 12 figs. Stuttgart, 1914.

A series of observations and experiments on the nature of the damage to cereals caused by hail has been carried out by the section of Plant Pathology of the Agricultural Institute of Bromberg. In these experiments damage similar to that caused by hail was produced by means of a special apparatus during the different stages of growth of the plants. The changes produced were examined microscopically and compared with those of similar appearance produced by parasites and frost. It was found that the causes of damage could be distinguished by the fact that frost attacked all the plants of a field indiscriminately, whilst the damage due to insects was localised and often showed traces of the insect bites and powdery débris; hail damage occurs uniformly throughout the field, or in lines or in a corner of the field only.

The writer arranges the types of damage in three groups: according as the hail comes before the appearance of the inflorescence, before and during flowering or after flowering. Some changes, *e. g.* the bleaching or kinking of the stem, may nevertheless appear in any of the three periods.

The damage produced before the formation of the inflorescence may be either direct, owing to the action of the hailstones in tearing the tissues, or indirect, owing to the subsequent attack of insects or fungi.

Injurious insects appearing in spring, especially certain Diptera and *Jassus sexnotatus*, cause damage only whilst the tissues are still young and tender. Under normal conditions, spring grain sown as early as possible and cultivated with care should be sufficiently advanced to escape their attacks; if for any reason growth is slow, it succumbs to the attack. A

delay of only 3 to 5 days may be decisive. It has been ascertained that in many cases this check was caused by hail.

Bleaching of the stem (death or whitening of the tissues of all or only a part of the culm). — Bleaching of the stems can only be attributed to hail when the marks of the hailstones are visible; if these are absent the damage should be attributed to frost or straw-blight ("take-all"). Sometimes the stem breaks at the height of a few inches or more from the ground owing to attacks of straw-blight (*Ophiobolus herpotrichus*, *Leptosphaeria herpotrichoides*, etc.) followed by wind, to wind alone, to animal pests (larvae of *Cephus pigmaeus*, of *Haltica vittula*, of various Diptera, etc.), or to hail storms. The damage due to the latter is distinguished from that due to other causes by the presence of marks produced by the hail, the direction of the bent stems (against the wind), and the variable height at which the stems are broken.

Bleaching of the ears of rye. — On poor soils it is not uncommon to find normal green stems of rye with empty ears of a more or less pale colour. The whitening of the ears may be due to frost, insects or hail. The ears whitened by frost remain firmly attached to the stem, whilst those whitened by insect attack or hail may easily be pulled off and separated from the last leaf-sheath. The whitening caused by insects (*Pediculoides graminum*, *Cephus pygmaeus*, etc.) is always limited to late ears.

The disease may appear also in wheat and oats, but is very rare in barley. Sometimes the inflorescence is more or less folded, a condition which may be caused by parasites (generally *Thrips*), frost or hail; the damage due to the latter is generally recognised by greater and more irregular diffusion in the field.

The destruction of the entire inflorescence, as in the bleaching, is rather rare; more frequently certain parts are destroyed. Sometimes the upper portion is deformed and decayed, and at other times the base or middle portion is damaged. In other cases the tip of the inflorescence is blanched, twisted, and of a feathery appearance ("Weissfedrigkeit"); similar damage may also be caused by attacks of *Cephus*, but this is distinguishable from damage due to hail owing to the affected ears occurring in groups and forming white patches here and there throughout the field, as well as by the presence of wounds. Sometimes the apical spikelets are destroyed but the inflorescence is not deformed ("Weissspitzigkeit"); this change is never produced by hail, but only by frost or insects.

Changes at the base of the inflorescence caused by hail are very rare and have never been observed by the writer. It is more difficult to determine when the changes in the middle portion of the ear should be attributed to hail or to other causes. They may consist of an atrophy of individual flowers, the presence of unfertilised flowers, and the absence of flowers and spikelets.

649 – **Changes Produced by Disinfectants in Seeds and Roots in Sandy Soils.** — HARTLEY, CARL, in *Bulletin of the U. S. Department of Agriculture*, No. 169, pp. 35, 1 plate. Washington, February 20, 1915.

For several years the writer has conducted experiments on the application of disinfectants to soils sown with different species of *Pinus*. During these experiments observations were made on the action of disinfectants on plants of *Pinus divaricata, P. ponderosa, P. resinosa, P. laricio* and the following weeds: *Eragrostis cilianensis, Echinochloa crus-galli, Panicum barbipulvinatum, Chaetochloa viridis, Mollugo verticillata, Portulaca oleracea, Amaranthus retroflexus, A. hybridus, A. graecizans, A. blitoides, Euphorbia glyptosperma*. The soil of the nursery in which the experiments were carried out was a sandy humus resting on a sandy subsoil.

It was evident that the toxicity of the disinfectants with regard to the roots of the plants depends on several factors: soil moisture, length of the roots (depth reached), period of application.

As a rule, disinfectants act in the soil in the same way as nutritive solutions, but with less intensity. Acid solutions show their greatest toxicity immediately after application. The quantities of disinfectant capable of causing toxic effects are less in proportion as the soil texture is more coarse (that is the more its absorption power is reduced) and the percentage of lime is higher.

Horsetails (*Equisetaceae*), pines, grasses and the commoner dicotyledons growing as weeds in the nurseries show very great differences in their resistance to sulphuric acid. In the above four groups the sensitiveness to acid disinfectants and toxic salts is greater as the position of the plant in the evolutionary scale is higher.

Sulphuric acid alone does not appear to be capable of utilisation on sandy soils which are intended to be sown later with garden crops. It is probable that this acid can be applied without danger to the majority of soils several days before sowing, if, immediately before sowing, a quantity of slaked lime is spread and raked in sufficient to neutralise $^3/_5$ or more of the acid used. This method is more economical than that of disinfection by means of formalin or heat. Further, it results in a considerable increase in the growth of several plants, often greater than that produced by heating.

Nurseries are disinfected by spraying with an aqueous solution of sulphuric, hydrochloric or nitric acids and sulphate of copper. Sulphuric acid was used at the rate of 3.50, 6.68, 13.69, 27.38, 57.75 cc. per sq. metre for studying its action on pines, and in stronger doses (up to 219 cc. per sq. metre) in the case of weeds. Hydrochloric acid was used at the rate of 59.84 to 178.9 cc. per sq. metre, nitric acid at the rate of 119.7 to 357.8 cc. per sq. metre and copper sulphate at the rate of 57 to 85 gr. per sq. metre. Other disinfectants studied were: formaldehyde, corrosive sublimate, common salt, heating to 80° C., etc.

Sulphuric acid diminished somewhat the germinating power of the pine seedlings at the two lowest strengths; many were destroyed at the medium strengths and almost all were killed at the highest strengths. The lowest doses of hydrochloric acid were not injurious to pines, but the highest dose

caused some injury. The lowest dose of nitric acid did not damage *Pinus* plants at all, or only very slightly; a double amount harmed them a little. Sulphate of copper at the above-mentioned rates 17 days before sowing caused little or no damage to pines. All four reagents produced changes in the roots of weeds resulting in the destruction of the root-tip after germination. The young plants thus affected always had much shorter and stouter roots, browned either at the tip or sometimes throughout. Those attacked by "damping-off" generally have roots of normal length and are diseased in several places. Several of the young affected plants developed new roots later and renewed their growth.

The damage is produced by a concentration of disinfectant at the surface of the soil. This concentration is due to the capillary rise of the soil solution and the evaporation of water from the surface. On a sandy soil under the climatic conditions of Nebraska, the changes in question can be obviated by means of frequent irrigations during the period of germination. When an acid is used as the disinfectant the changes can be avoided by liming the soil a short time after disinfection. This method does not give very good results for pine nurseries, for which the former method is better, but it appears to be the only one suitable to prevent injury to young angiosperms.

Acids may be applied to nurseries at the period of sowing without injury to dormant pine seeds. Formaldehyde and corrosive sublimate in sufficient concentration for disinfection should be applied several days before sowing or otherwise the dormant seeds may be destroyed. The changes produced by formaldehyde applied before or at the moment of sowing are in no case as serious as those by acids and salts on pines.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

650 - **Bacteria and Fungi Observed on Cultivated Plants in the Province of Turin and Neighbouring Districts during 1913.** — VOGLINO, PIERO, in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LVII (1914), pp. 159-174. Turin, 1915. GENERALITIES

The writer has arranged the data collected in 1913 regarding the diffusion and life-history of the principal species of parasitic bacteria and fungi observed in the province of Turin and the adjacent districts studied in the Turin Phytopathological Observatory (1).

The persistent rains and the prolonged cool period during the second fortnight in April caused death of the young tissues and withering of the buds of pear and apple and even of chestnut coppice, as well as bringing about an extraordinary developement of *Exoascus* on peach, cherry and plum. This damage was particularly severe in the submontane region, where much fruit is grown. Frosts also killed flowers and fruit, especially of peach. However, the long summer drought subsequently afforded very unfavourable conditions for the development of parasites.

(1) See *B.* Sept. 1914, No. 856. (*Ed.*)

The systematic list drawn up by the writer includes about ninety forms, and specially records a new bacterial disease found on the leaves of young plants of sweet basil (*Ocymum basilicum*) from the Savona district in October 1913 ; in another article a full description will be given of the life-history of the new microorganism.

Phomopsis mori Vogl. (new), often associated with *Hendersonula mori* Sacc. et Vogl. and with *Dendrophoma teres* Sacc., is recorded on mulberry branches in an advanced stage of decay (owing, it appears, to the attack of *Hendersonula*) in a nursery garden in tha province of Novara.

Gloeosporium musarum Cooke et Massee was recognised as the cause of a considerable alteration in the fruits of *Musa cavendishii* (= *M. chinensis*) sold in the Turin market and coming from the Canaries, etc.

651 – **New Fungi from Germany, Japan and Brazil.** — BUBÁK, FR., and SYDOW, H., in *Annales Mycologici*, Vol. XIII, No. 1, pp. 7-12, figs. 1-13. Berlin, 1915.

A systematic description of two genera and eleven new species collected in Germany (1 genus and 9 species, from 1910 to 1912), in Japan (1 genus and 1 species, in 1910) and in Brazil (1 species, in 1897).

Amongst the new representatives of the German mycological flora are found *Phyllosticta diedickei* Bubák et Sydow, observed on living leaves of ash (*Fraxinus excelsior*) at Erfurt ; *Gloeosporium marginans* Bubák et Sydow, found on living leaves of oak (*Quercus robur*) on the island of Sylt ; and *Pachybasidiella polyspora* Bubák et Sydow, found on living leaves of *Acer dasycarpum* at Tamsel (Brandenburg).

652 – **New Fungi from Moravia.** — BUBÁK, FR., in *Annales Mycologici*, Vol. XIII, No. 1, pp. 27-34. Berlin, 1915.

Amongst fifteen species new to science collected in Moravia are included : *Mycosphaerella* (*Sphaerella*) *occulta* Bubák, on leaves of *Rhododendron ponticum hybridum* ; *Pleospora spiraeina* Bubák, on branches of *Spiraea opulifolia* ; *Phyllosticta cheiranthicola* Bubák et Zimmermann, on living leaves of wallflower (*Cheiranthus cheiri*) ; *Phyll. occulta* Bubák, on leaves of *R. ponticum hybridum* ; *Fusicoccum petiolicolum* Bubák, on petioles of the horse-chestnut (*Aesculus hippocastanum*) ; *Hendersonia gigantispora* Bubák, on leaves of black currant (*Ribes nigrum*) ; *Cercospora exosporioides* Bubák, on leaves of larch (*Larix europea*).

653 – **Specialisation of Parasitism in *Melampsora lini*.** — BUCHHEIM, ALEXANDER, in *Berichte der Deutschen Botanischen Gesellschaft*, Vol. XXXIII, Part 2, pp. 73-75. Berlin, March 1915.

Melampsora lini, according to Saccardo, has been found on *Linum catharticum*, *L. marginale*, *L. usitatissimum*, *L. alpinum*, *L. narbonense*, *L. perenne*, *L. nodiflorum*, *L. strictum* and *L. austriacum* ; more recently E. Mayor has observed it on *L. tenuifolium*.

As it has repeatedly been asserted that the rust-fungi on *L. usitatissimum* and *L. catharticum* are different, the writer undertook to investigate whether *M. lini* shows further specialisation.

During the summer of 1914, he was able to procure uredospores of *M.*

lini collected from plants of *L. catharticum*. *L. alpinum*, *L. strictum* and *L. tenuifolium* from different places.

The *Linum* plants which were the subject of his experiments came, in almost every case, from Geneva, Lindau and St. Gall. Specimens of *L. usitatissimum* from the Berne Botanical Garden and wild seedlings were also used. The *L. catharticum* used was from places in which there was no fear of infection by *Melampsora*; further, control plants were always kept, and in no case did such plants show infection; it may therefore be reckoned with a fair amount of certainty that the plants of *L. catharticum* used in the experiment had not been spontaneously infected by *Melampsora*.

The first experiments were in six series, with uredospores from *L. catharticum* sown on to: *catharticum*, *usitatissimum*, *campanulatum*, *capitatum*, *austriacum*, *alpinum*, *lewisii*, *narbonense*, *maritimum*, *flavum*, *sibiricum* and *tenuifolium*. Positive results were always obtained with *L. catharticum*, but with this species only, showing that the *Melampsora* on this species is specialised.

Similar results were obtained in the other cases: thus uredospores from *alpinum* infected only *alpinum*, those from *tenuifolium* only *tenuifolium*. No plants of *L. strictum* were available, but uredospores from this species gave no infection on any other species of *Linum*.

These infections should be repeated, for the plants that the writer had at his disposal had recently been transplanted and in many cases died prematurely. Nevertheless it can be said that *M. lini*, like other species of the genus (*e. g. M. euphorbiae*), shows great specialisation.

654 - **On the Development of *Gloeosporium musarum*, a Parasite of the Fruits of *Musa chinensis*** (1). — SAVELLI, MARIANO, in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LVII (1914), pp. 184-192, 1 plate. Turin, 1915.

For the production of bananas for export to Europe, *Musa cavendishii* (= *M. chinensis*) has been exclusively adopted in the Canaries. This species has undoubtedly the advantage of standing a colder climate than *M. paradisiaca* (= *M. sapientum*) and its varieties; further, its fruit bears long voyages better.

During the winter of 1913, Prof. P. Voglino observed a serious disease on Las Palmas bananas, which are much esteemed on the Turin market. There were observed on the surface of the fruits, patches of rot, isolated or occasionally continuous, and often sunken. The central portion of the patch and also the periphery were of a darker brown colour than the remainder. In the central portion of the patch were found numerous little fungoid pustules shaped like small pads and carnation-red in colour. These were arranged in an almost elliptical group, relatively concentric with the edge of the patch. On the lower portion of the fruit and more particularly in the neighbourhood of the stalk, the patches were usually more numerous and were almost always united in such a way as to involve

(1) See also *B.* Feb. 1911, No. 630, and No. 650 above. (*Ed.*)

the entire base. They often extended the whole length of the stalk, which was in a more or less advanced stage of decay. The cortex of the fruit may split longitudinally, thus exposing the flesh ; sometimes there issues from the crack a mucilaginous substance with a putrid odour, due to the decomposition of the pulp. This latter then appears sunken, rotten and of a brownish colour. Microscopic examination reveals abundance of hyphae.

The bananas are consequently much depreciated in value owing to their ugly shape, rotten pulp and the blackish colour of the skin.

The disease described above is undoubtedly due to the action of *Gloeosporium musarum* Cooke et Massee.

An artificial culture enabled the writer to determine that the mycelium usually grows actively until the fifth or sixth day after the sowing of the conidia and continues to spread slightly up to the tenth or twelfth day. The conidia begin to form towards the fourth or fifth day and are usually arranged in capitula supported by short filaments; these unite and so form, on the twelfth day, the masses of mycelium. By the eighteenth day these masses have become differentiated into circular reddish pustules.

Further, *G. musarum*, when grown as a culture, behaved for some time like a Hyphomycete ; then it gradually assumed an appearance resembling somewhat that of the *Sphaeropsidales*, for the fruit-cavity is closed, and contains spore-bearing pseudobasidia. On the other hand, the conceptacle is very far from being a typical pycnidium. The writer has always observed two or three conceptacles differing from one another in shape and size and unequal pseudobasidia developing in an irregular manner. It can also be argued that there can be no question of a real pycnidium because the conceptacle opens here and there to allow of the escape of the masses of conidia. This micromycete, which in the natural state seems to behave as a typical member of the *Melanconiaceae*, appears to have a tendency in artificial cultures to change its systematic position and gravitate towards the order of *Sphaeropsidales*, behaving like the *Leptostromaceae*.

Finally, the researches made by the writer to ascertain whether *G. musarum* is capable of causing serious harm to the leaves of the species of *Musa* usually grown in gardens, seemed to show that this fungus can only live as a parasite upon injured leaves and that *Gloeosporium* is not, for the present at least, a fungus to be feared, as it is only able to produce patches upon the leaves of these species.

MEANS OF PREVENTION AND CONTROL

655 – **Chemical Methods of Controlling Plant Enemies** (1). — Tommasi, G., in *Annali di Chimica applicata*, Vol. III, Nos. 3 and 4, pp. 111-146; and in *Annali della R. Stazione chimico-agraria sperimentale di Roma*, Series II, Vol. VII, Part 2, pp. 147-218. Rome, 1915.

After having touched on the different methods of controlling plant pests, both fungoid and animal, the writer reviews a considerable number of publications that appeared in 1913 and during the first half of 1914 dealing with chemical methods for the protection of crops (copper salts, sulphate of iron, formaldehyde, sulphur, polysulphides, lime-sulphur mixtures, carbon disulphide, soap, petroleum, carbolineum-phenols, nicotine, arsenical preparations and hydrocyanic acid).

(1) See also *B.* Feb. 1914, No. 180. (*Ed.*)

656 – **"Bacteriosis" of the Cucumber in Italy.** — TRAVERSO, G. B., in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series V, Vol. XXIV, 1st Half-year, Part 5, pp. 456-460. Rome, April 5, 1915.

In this preliminary account, the writer treats of the "bacteriosis" of the cucumber (*Cucumis sativus*), recorded in May 1914 by the Director of the Travelling Chair of Agriculture of Chioggia (Venice), as a disease manifesting epidemic characters and threatening severe injury to the neighbourhood of Chioggia, where cucumbers are grown on a large scale and are the objects of an important export trade.

The roots and young shoots of plants attacked by the disease show no abnormalities. On the under surfaces of the leaves, however, if they are examined early in the morning, there may be detected areas of almost circular, or when limited by the veins, angular shape, about 2-5 mm. wide. From these there exudes an entirely or almost entirely colourless liquid which, after some hours, evaporates, leaving behind a patch that is first yellowish in colour and afterwards becomes whitish and dry. The tissues attacked, which become very fragile, wither completely and die. The leaves appear pitted, soon lose their turgescence, and curl. The dead tissues become detached and rot, and finally the leaves themselves are reduced to shapeless shreds.

The fruits, which may be attacked at any stage of their development, first show small livid patches exuding, after a few days, a viscous substance, which on contact with the air turns an amber colour, hardens and forms hard gummy masses, spheroidal or irregular in shape (especially if several infected spots are close together so that their excretions unite), and having usually a diameter of 1-2 mm. but sometimes attaining 1 cm. If attacked during the first stages of their development, the fruits remain atrophied and deformed and may be considered as lost ; if the disease attacks them when they have already attained a more or less advanced stage of development, their flesh becomes soft and watery. The rot first starts in the diseased patches and spreading all round renders the fruit useless and, in fact, a centre of infection if it is placed near sound cucumbers.

Microscopic investigation has revealed numerous bacteria in the diseased portions and the gummy excretion. Amongst the different forms of bacteria isolated from infected fruits, there is one occurring in far larger numbers than the others, which should consequently be regarded as the probable cause of the disease. The bacterium in question is mobile, fluorescent, incapable of liquefying gelatine, and apparently corresponds to the *Pseudomonas* mentioned in 1914 by O. I. Burger as the cause of a disease that for four years has caused great damage to cucumbers in Florida, and which from its symptoms seems to be the same as that recorded in Italy.

The control experiments undertaken by the Director of the Travelling Chair of Agriculture of Chioggia, consisting of spraying with a 0.5 to 1 per cent base of Bordeaux mixture together with powdered sulphur and 1 per cent copper sulphate, have not given good results. According to Burger, Bordeaux mixture would be very efficacious if the treatment were

begun while the plants are very young and only bear 3 or 4 leaves, and if it were carried out carefully every 10 days.

The writer intends to continue his study of this serious disease.

657 – **Further Spread of " Seccume " (Withering) of the Fig-Tree in Italy** (1). — SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura in Acireale, Bollettino* No. 18, pp. 1-3. Acireale, 1915.

In a fresh contribution to the account he has already given respecting the disease called by him " seccume del fico " (withering of the fig-tree), the writer states that it is not limited to the Peninsula of Sorrento, but has spread to other places. It becomes increasingly destructive every year, and may even cause the death of the tree attacked. This disease is known in the Province of Messina; the writer has himself found it in Calabria and recently in the neighbourhood of Palermo.

From the results obtained in 1914, Sig. Savastano confirms the efficacy of the treatment already suggested.

If the trees have been attacked for some years, and the disease has taken a certain hold upon them, it is necessary to cut back the branches till a part is reached that appears healthy. The appearance on the surface of the cut of more or less distinctly marked reddish rays, with black edges, is a sign of the disease, and the cutting back must be continued till the point is reached where this discoloration ceases. In certain very severe cases, the trunk may even be reached in this way and it, too, must have the diseased part removed in order that the tree may throw out fresh branches.

As to the propagation of the fig-tree, if the tree from which it is wished to take cuttings has already some infected branches, it is better, as a precaution, to reject it.

658 – ***Typhulochaeta japonica* n. g. and n. sp., Parasitic on the Leaves of *Quercus glandulifera* in Japon.** — ITO SEIYA in *The Botanical Magazine*, Vol. XXIX, No. 338, pp. 15-22, 1 plate. Tokio, February 1915.

During the autumn of 1914, the writer received from K. KARA specimens of a fungus parasitic on the under side of the leaves of *Quercus glandulifera* in the Province of Mino, Japan.

Microscopic examination showed that it was a representative of a new genus (*Typhulochaeta* S. Ito et Kara n. g.) which they describe as *T. japonica* S. Ito et Kara n. sp. The conidial (*Oidium*) form has not yet been observed.

It is characterised by the presence of simple club-shaped hyaline appendages attached to the upper portion of the perithecium.

659 – ***Fomes juniperinus* Parasitic on *Juniperus procera* in British East Africa.** — WAKEFIELD, E. M., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 3, pp. 102-104, 1 fig. London, 1915.

Amongst some fungi from Nairobi were found two specimens of *Fomes juniperinus* (v. Schr.) Sacc. et Syd. This polyporus represents the most dangerous parasite of the East African forests and as far as is known it has

(1) See also *B.* Jan. 1915, No. 112. (*Ed.*)

only been found on indigenous junipers, of which the commonest and only determined one is *J. procera*.

The trees bearing the fruit-bodies of the fungus always show considerable rot in the central portion when cut down.

F. juniperinus has been described by VON SCHRENK as the cause of "white rot" of *J. virginiana* in the United States, a disease characterised by long galleries in the heartwood. Another parasite of *Juniperus* which has also been described is *F. earlei* (Murr.) Sacc. et D. Sacc., believed by MURRILL to be closely allied to *F. juniperinus*. With regard to the distribution of the latter, it occurs in the United States in Tennessee, Kentucky and Maryland, whilst *F. earlei* has been found in Texas, New Mexico, Arizona and Colorado. LLOYD has recorded *F. juniperinus* in Russia and remarks that *F. demidoffii* (Lév.) Sacc., reported on *J. excelsa* in Russia, is probably identical with *F. juniperinus*, which supposition is supported by this new occurrence in a locality very clearly distinct from previous habitats.

WEEDS AND PARASITIC FLOWERING PLANTS.

660 – ***Eichhornia crassipes*** (1) **in Viti Levu, Fiji.** — STEWART, D. R., in *The Fiji Planters' Journal*, Vol. II, No. 21, p. 343. Suva, March 1915.

Reports from the District Commissioners of the Colony of Fiji show that the water-hyacinth (*Eichhornia crassipes*) is widely distributed in the rivers of Viti Levu, but does not occur in the other islands. Legislative measures for the eradication of this and other weeds are proposed.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

661 – **New Species of Chalcididae Collected in Africa and Persia.** — WATERSTON, JAMES, in *Bulletin of Entomological Research*, Vol. V, Part 4, pp. 343-372, figs. 1-17. London, March 1915.

MEANS OF PREVENTION AND CONTROL

The writer gives a systematic description of the following Chalcids: 1) *Pleurotropis neavei* n. sp., reared from a butterfly chrysalid (*Charaxes* sp.) collected in Nyasaland; it is not improbable that this insect is hyperparasitic on one species of Chalcid; 2) *P. neavei* var., obtained from cocoons of a Braconid (*Apanteles* sp.) in German East Africa; 3) *P. clinognathus* n. sp., bred from a host the name of which is not given, in Southern Nigeria; 5) *P. amaurocoela* n. sp., obtained from a microlepidopterous larva, *Pyroderces simplex* Wlsm., living in cotton pods in Egypt, from cocoons of *Apanteles* sp. parasitic on *Sylepta derogata* injurious to cotton in Northern Nigeria; and with *Tetrastichus* sp. from *S. derogata* in Nyasaland; 6) *P. homoea* n. sp., reared from larvae of *Busseola fusca* Hmp. (Lepidoptera),

(1) See *B.* Aug. 1914, No. 798. (*Ed.*).

very injurious to maize in Nyasaland ; 7) *P. mediopunctata* n. sp., obtained from a Coccinelid pupa in Southern Nigeria ; 8) *P. africana* n. sp., obtained from eggs of Hemiptera (?) in Nyasaland ; 9) *P. violacea* n. sp., reared with *Tetrastichus* sp. from eggs of *Heteronygmia leucogyna* Hmp. (Lepidoptera), very injurious to the leaves of *Khaya senegalensis* in Nyasaland ; 10) *P. illustris* n. sp., collected in Persia ; 11) *Syntomosphyrum glossinae* n. sp., reared from a puparium of *Glossina palpalis* R. D. in *Uganda* ; 12) *S. phaeosoma* n. sp., reared with *P. amaurocoela* from a cocoon of *Apanteles* sp., parasitic on *Sylepta derogata* in Northern Nigeria ; 13) *Tetrastichus melichlorus* n. sp., collected on the Gold Coast.

662 – **New Species of Chalcididae in Ceylon.** — WATERSTON, JAMES, in *Bulletin of Entomological Research*, Vol. V, Part IV, pp. 325-342, figs. 1-6. London, March 1915.

A systematic description of 7 new Hymenoptera of the family *Chalcididae*, parasitic on other insects, collected at Peradeniya (Ceylon) : 1) *Polycystus propinquus* n. sp., on *Agromyza phaseoli* Coq. ; 2) *Trigonogastra rugosa* n. sp., parasitic on the same fly ; 3) *T. megacephala* n. sp. collected on the fruit of *Artocarpus* attacked in its turn by an insect of undetermined species ; 4) *Closterocerus insignis* n. sp., on *Oscinis theae* ; 5) *Sympiesis purpureus* n. sp., on *Acrocercops ordinatella* Meyr., which bores galleries in the leaves of camphor (*Cinnamomum camphora*) ; 6) *Syntomosphyrum taprobanes* n. sp., parasitizing a Coccinellid, *Scymnus* sp. ; 7) *Tetrastichodes asthenogmus* n. sp., described from two specimens on the egg-capsule of a Blattid.

663 – **Chemical Methods of Controlling Plant Enemies.** — See above, No. 655.

664 – **The Control of Grasshoppers in Russia.** — OUVAROFF, B. P., in *Selskoie Khosiaistvo i Liesovodstvo* (Rural Economy and Sylviculture), Vol. CCXLVII, Year LXXV, pp. 266-281 and 377-414. Petrograd, February-March 1915.

The writer gives the history of the control of these destructive insects in Russia and reviews the different methods employed and the results obtained with each.

The species of grasshopper most commonly found in the country and the most destructive are : *Pachytilus migratorius* L., *Stauronotus maroccanus* Thunb., and *Caloptenus italicus* L.

Pachytilus migratorius is common in the South of Russia and its chief breeding centres are to be found in the lower parts of the rivers feeding the basin of the Caspian Sea and the Lake of Aral : Volga, Ural, Kuma, Terek, Araks, Sir-Daria, etc. In the vast steppes of these regions, the insect evidently finds the best conditions for its existence and periodic reproduction, for it invades places very distant from its breeding centres. It is interesting to notice that the districts frequented by the insect are diminishing, for it has been recorded that whereas breeding centres were once numerous in the steppes of the basin of the Black Sea, these are now disappearing. *Stauronotus maroccanus* is seldom found in Russia-in-Europe, and the centres of its activities are the virgin steppes of Turkestan, the Transcaucasus and North Caucasus. However, in this last region, the injurious effects of the " Morocco locust " are very perceptibly decreasing, owing to the ever-

increasing cultivation of wheat, which gives rise to soil conditions that are unfavourable to the deposition of the eggs by these grasshoppers, preferring, as they do, for this purpose, virgin steppes, and compact soils in general. *Caloptenus italicus*, the Italian locust, is very common, being found throughout Central and South Russia, in the Caucasus and in Asiatic Russia. Nevertheless, the injury done by this species is much less in comparison, for *Caloptenus italicus* lays its eggs in dry and very compact soils, viz., either on virgin land or on land which has lain fallow for many years ; such land is now rarely found in Central and South Russia.

The control measures adopted against grasshoppers are, as is well known, mechanical, chemical and biological.

Mechanical methods (traps, burning and collecting) are the oldest and most elementary and all represent passive defence. Given the habits of these insects, passive measures of control are wholly insufficient, because their aim is merely to clear the cultivated land of larvae. But this land, even when free of larvae, will be destroyed by the grasshoppers as soon as they develop wings, for there is then no means of protecting the fields from their attack. The final result of mechanical means can therefore not be regarded as positive. The conclusions as to the inefficacy of mechanical means are based, in the writer's opinion, not merely on abstract reasoning, but also on the fact that throughout the history of the long and troublesome control of grasshoppers in Russia, no case has occurred of the effectual destruction of these pests over an extensive tract of country. Further, mechanical methods require so much labour that it is impossible to adopt them in the case of vast districts, unless the work can be done gratuitously.

The chemical methods are based on the use of poisonous substances acting either by contact or as internal poisons. They are very widely employed and have acquired a much greater importance than any of the other systems of control, this preference being justified by the results obtained. Amongst the toxic substances used, arsenites take the first place as being the least expensive.

In Russia they previously employed Schweinfurt green, Paris green, or aceto-arsenite of copper with lime. However, owing to the difficulty of procuring good quality lime at a low price, the use of sodium arsenite has of late much increased. The latter is preferable to Schweinfurt green because it is completely soluble in cold water, is less expensive, and its action is more rapid and efficacious.

Amongst the sprayers used in Russia the most commonly employed are machines drawn by horses, especially the "Vermorel" and "Platz" makes. In Turkestan, the region which suffers most from the invasions of grasshoppers, the former type is popular, more than 300 Vermorel sprayers being now in use there. Knapsack sprayers are less common ; however, the writer says that in selecting a sprayer, it is necessary to bear in mind the fact proved by the history of grasshopper control in Russia, viz., that by using chemical methods in a particular district it is certain that after 2 or 3, or at most 5, years (if the control has been systematically carried out), the district will be

freed from these pests. The sprayers can then be used for the needs of horticulture and viticulture. The system of treating with toxic compounds any plants that are likely to be attacked by these pests has great advantages. In the first place it is less expensive than the use of mechanical methods; secondly, as regards efficacy, although the writer does not believe it possible to destroy every grasshopper larva in a particular region, nevertheless spraying, when systematically carried out, absolutely ensures that after a single season's treatment the grasshoppers will so far be destroyed that in the future the injury caused will have no further economic importance.

Spraying, however, has its defects: its success for instance depends upon the action of the atmosphere, etc., and for this reason an attempt has been made to use poisoned substances readily eaten by the grasshoppers. The problem of finding a substance that is more attractive to the latter than their natural food has been solved by American entomologists. They have discovered that bran is such a substance, and that it is rendered still more appetising by the addition of oranges, lemons, etc. The preparation of the poisoned food is simple. To an aqueous solution of sodium arsenite are added as much bran and molasses (the latter may even be omitted) as is necessary to make a paste of such consistency as to be easily distributed in very light small pieces. This paste is scattered over the ground occupied by the insects in a manner similar to that in which seed is broadcasted by hand. The use of poisoned bran, which in the United States of America has already entirely replaced that of sprays, as being simpler, more economical and more effective in controlling grasshoppers, has also been tried in Russia and has given more than satisfactory results. Thus in the province of Stavropol, where experiments have been made with this method, it was found that the cost of poisoning any area was from ½ to ¼ the cost of spraying.

In Russia, the so-called biological control method has not yet been studied in a satisfactory manner.

The writer concludes by stating that, at the present time, the chemical method, and especially the use of poisoned substances, e. g. bran, forms (having regard to the cost relatively to the results obtained) the only really satisfactory and systematic treatment.

It is to this method that will belong the honour of having definitely freed Russia from the invasion of these destructive insects.

665 – **The Vine Moths (*Polychrosis botrana* and *Conchylis ambiguella*) in Piedmont, Italy: Life-History and Control** (1). — TOPI, MARIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classi di Scienze fisiche, matematiche e naturali*, 1915, 1st Half year, Vol. XXIV, Part 5, pp. 464-468, 1 fig. Rome, April 5, 1915.

In the spring of 1914, the writer found 56 cocoons with pupae in the 32 bands of cloth that he had affixed in the preceding summer to vines at Alice Bel Colle in the Upper Monferrato (Italy) to serve as traps for larvae (Catoni method).

(1) See also *B.* June 1914, No. 590; *B.* Oct. 1914, No. 969; and *B.* Nov. 1914, No. 1078. (*Ed.*)

From these pupae he obtained 32 *Polychrosis*, only 2 *Conchylis* and 8 parasitic Hymenoptera. These figures agree on the whole with those obtained during 1913 under similar conditions. The smaller number of parasitic Hymenoptera collected in 1914 should, however, be noted, together with the fact that these emerged when more than half the moths had already left their pupae.

This does not agree with what is believed and habitually stated, *viz.* that the parasites appear much earlier than the moths.

From the practical point of view, it may be deduced that if the vine bark, the tips of the canes used as props, or the bands of cloth applied to the vines, all of which may harbour pupae, have been placed in boxes covered with wire-netting (in order to allow the parasites to complete their development and escape, but not the moths), it is advisable to keep these boxes a considerable time and not to destroy them when the first moths appear, as has often been advised. Further, delay in stripping the vines with the object of giving the parasites time to emerge does not always meet the end in view.

In spring, summer and autumn, the writer repeated the trials of trapping the moths in fermenting molasses and water, placed in four bowls distributed in a vineyard that was severely attacked ; the object was to follow the course of the emergence and to determine whether there was a third brood. The insects caught in the spring were very few in number (12 *Polychrosis* and 3 *Conchylis* from May 12 to June 1, without a maximum period of emergence). In the summer, the number of captured imagines of the first brood was sufficiently large (131 *Polychrosis* and 12 *Conchylis*, with two maximum periods of emergence, *viz.* from July 15 to 18 and from July 24 to 30). In the autumn, no moths were caught.

From his observations the writer deduced, as far as the district of Alice Bel Colle was concerned, that: 1) there exists an absolute predominance of *Polychrosis* over *Conchylis* ; 2) the emergence is prolonged in spring for about 20 days and in summer for about 30 ; 3) the spring emergence continues from beginning to end with almost unvarying regularity, while in summer there is a maximum during the second fortnight in July ; 4) there are only two broods in the year, the adults of the second emerging in the following spring.

During the flight season it is possible to see the process of egg-laying at dusk. In May, the writer was able to follow the process in the case of *Polychrosis*. The female, when about to deposit her eggs, flies with sure, steady flight to the bunches of flowers, alighting upon them without hesitation. After depositing an egg, she rises and flies to another bunch, or returns to the same. The egg is laid upon any part of the flower bud or on the bracts ; in captivity the moth will lay upon any portion of the plant. The egg is lenticular and very small, adhering by one of its faces ; its outline is elliptical ; it is pale grey in colour, transparent, finely reticulated and gives iridescent reflections.

The flight of the males differs from that of the females, being more rapid and less direct ; they disappear from sight in a very short time.

In the locality studied, flowering commenced, in the most sunny positions, at the commencement of June.

The *Conchylis* larvae reached maturity sooner than those of *Polychrosis*.

As insecticides for the destruction of the larvae, a 0.8 % solution of Swift's arsenate of lead was used in spring, and in summer a 2.5 per cent tobacco extract mixed with Bordeaux mixture and sprayed in intermittent jets, especial care being taken to wet the bunches. In a vineyard where Lambrusca and Moscato vines were chiefly grown, only alternate rows were sprayed; there were two spring sprayings with arsenate of lead, on May 28 and June 13 respectively, and one summer spraying with tobacco extract on August 3. Another vineyard planted chiefly with Barbèra, was treated only once, on August 5, with tobacco extract, the same system being employed for the control as above.

On looking at the crop in the summer and judging it as a whole, it would have been impossible to distinguish at a glance, by the condition of the grapes, the rows that had been treated from those that had not. However, a minute examination of the berries showed that the spraying had been undoubtedly efficacious. In the first vineyard 4 plants of Moscato were selected (2 treated and 2 untreated) and 2 of Lambrusca (1 treated and 1 untreated), having respectively the same number of bunches. The examination of the berries proved that of the grapes of the 2 treated Moscato vines, 343 berries had been destroyed against 547 in the case of one untreated plant; as regards the Lambrusca variety 248 of the berries of the sprayed vine were destroyed, as against 290 in the case of the unsprayed vine. In the second vineyard, two plants of the Barbèra variety were chosen (1 treated and 1 not), each having 36 bunches. Of the berries of the treated vine 442 were destroyed or damaged, and of those of the untreated vine as many as 759.

INSECTS INJURIOUS TO VARIOUS CROPS

666 – **New Species of Coleoptera on Cotton in Peru.** — PIERCE, W. DWIGHT, in *Report* 102, *United States Department of Agriculture*, 16 pp., plates I-II, figs. 1-6. Washington, 1915.

Beetles are among the most important enemies of cotton in Peru. Considering the trade in cotton seed between this country and the United States the writer considers it useful to publish the systematic description of new species of weevils obtained by C. H. T. TOWNSEND by breeding from the stems, flower buds and bolls of cotton from Piura.

1) *Mylabris peruanus* n. sp.; 2) *Pachybruchus verticalis* n. sp.; 3) *Spermophagus piurae* n. sp.; 4) *Eustylomorphus squamipunctatus* n. g. and n. sp.; 5) *Menetypus variegatus* n. sp., all on the flower buds; 6) *Sibinia peruana* n. sp. on the same; this is the first species of *Sibinia* described from Peru and the third known in South America; 7) *Gasterocercodes gossypii* n. g. and n. sp., on stems; undoubtedly a dangerous pest of the cotton plant.

The writer also describes *Geraeus perscitus* Herbet, on the bolls, and *Anthonomus vestitus* Boheman ("Peruvian cotton square weevil") on the flower buds.

667 - **Weevils injurious to Tea, *Mangifera indica* and *Phaseolus mungo* in India.** — MARSHALL, GUY A. K., in *Bulletin of Entomological Research*, Vol. V, Part 4, pp. 377-380, figs. 1-4. London, March 1915.

The following new species are described:

1) *Phytoscaphus dissimilis* attacking the young shoots of tea in Assam; 2) *Rhynchaenus* (*Orchestes*) *mangiferae*, the larvae of which attack the leaves of *Mangifera indica* in the Presidency of Madras; 3) *Pachytychius mungonis*, injurious to the seeds of *Phaseolus mungo* in the same province.

Corigetus bidentulus Fst. is also recorded as very injurious to tea in Assam.

668 - ***Macrosargus cuprarius*, a European Fly Recorded on Strawberries in Connecticut and Occurring in several Other Localities in America.** — BRITTON, W. E., in *Psyche, A Journal of Entomology*, Vol. XXII, No. 1, pp. 29-31, 1 fig. Boston, Mass., February 1915.

In May 1914 the writer received specimens of an insect collected on strawberries at Wallingford (Connecticut), which was identified as *Macrosargus cuprarius*. This European fly was also recorded in the same year on *Azaleas* imported from Holland in New Jersey, where the insect was first obtained in 1892. It was recorded again in New York State and in Quebec in 1901; in Massachussetts in 1903-1904; in Maine and Connecticut in 1909; in New Hampshire in 1913; in Rhode Island and also in Canada in 1914.

669 - ***Incurvaria* (*Lampronia*) *rubiella*, Injurious to the Raspberry (*Rubus idaeus*) in Germany.** — LÜSTNER, GUSTAV, in *Deutsche Obstbauzeitung*, Year 1915, Part 7, pp. 90-91, 2 figs. Stuttgart, April 1, 1915.

The writer records the injury caused to raspberry canes (*Rubus idaeus* L.) by *Incurvaria rubiella* Bjk.

In the spring, when the new shoots are growing, several buds lying one above the other remain passive and fail to develop. These buds at first retain their green colour; later they turn brown and wither and finally fall or decay. As a consequence, the foliage of the new shoots is very scanty and thin. As these symptoms will occur at the beginning of spring, they are likely to be confused with those produced by cold.

However, if a shoot bearing buds that have failed to develop is cut in half, it is easy to see a gallery which runs from the pith towards the bud. The excavation of this passage, which entails the death of the bud, is the work of the larva of *Incurvaria*.

For the control of the parasites, the writer advises the removal and burning of the shoots attacked.

670 - **Mediterranean Fruit Fly (*Ceratitis capitata*), a Parasite of Peaches, Recorded as New to Madagascar** (1). — LEGENDRE in *Colonie de Madagascar et Dépendances, Bulletin économique*, Year 14, No. 3-4 (3rd and 4th Quarters 1914), p. 242. Antananarivo, 1915.

Of the peaches belonging to the commonest local variety known as "Malgache" which were sold on the January market, 8 per cent were at-

(1) See also *B.* May 1915, No. 563. (*Ed.*).

tacked by amber-coloured larvae. At the end of February not a single sound peach remained, evidently a great loss from the commercial point of view. From some of these larvae reared in the laboratory, were obtained, after about a month and a half, adults of *Ceratitis capitata*, which the writer does not remember to have been previously recorded in Madagascar.

The peach trees imported from the Cape of Good Hope which are cultivated at the Hanisana Station, have been practically immune from the attacks of the insect, only some of the latest fruits having shown traces of punctures.

This is probably due to the fact that these peach trees come into bearing a month earlier than the "Malgache" variety, at a time when *Ceratitis* has not yet begun to deposit its eggs.

Mangoes (*Mangifera indica*) and orange trees are rarely attacked, probably because the fly has already finished its annual cycle when the fruit of these trees ripens, in March and April.

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

The Principal Varieties of Wheat grown in the Argentine Republic

by

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From the area it occupies and its wide geographical range wheat is the most important crop in the Argentine; it is in fact grown on about 17 million acres and is thus cultivated much more extensively than oats, though the latter have recently made great progress, occupying as they now do over 3 million acres every year. The sowing of this area requires about 18 million bushels of wheat, worth normally over 40 million pesos, and at the present price 50 to 60 million pesos (1). In view of the value of the seed and the influence of its quality upon the resulting crop, everyone should realise the importance of careful selection and the need of precaution in buying seed.

Nevertheless, the choice of seed wheat (and also of the seed of other crops) does not meet with sufficient care and attention on the part of the Argentine farmers. Some even go so far as to deny its importance, basing their opinion on incomplete or erroneous observations; many do not know how to set about selecting, or have not the means of procuring good seed. For these and other reasons, seed is sown that should have been discarded.

It would be wrong, however, to attribute entirely to defective or insufficient seed the low average yield of wheat over the total area sown (less than 12 bushels per acre); this is obtained without manure, it is true, but generally on fertile soil which has only been under the plough for a few

(1) On the basis of gold pesos, this would be 10 to 12 millions sterling; calculating as paper it amounts lo 4 ½ to 5 millions. (*Ed.*).

years. These factors however, undoubtedly do exercise considerable influence, and careful selection should be the first step towards the necessary improvement of the Argentine wheat fields.

It is essential, not only to obtain seed of good appearance, large and well filled, and derived from sturdy parents, such seed being also free from disease and devoid of any admixture, but also to choose in each case the variety best adapted to the particular circumstances. It is only fair to recognise that the varieties usually found on the market are the most suitable, seeing that they are acclimatised, and resistant to the various meteorological conditions to which they are exposed, yielding large crops of good quality; such wheat is in great demand both for home consumption and for export.

The varieties known as *Barletta, Russian, Italian* or *Lombard, French* or *Bordeaux, Rieti, Hungarian, Tuzela* and *Richela* amongst soft wheats, and *Candeal* and *Taganrog* amongst hard wheats, are all suitable for the vast area under wheat in Argentine. As they have been grown for many years and have often been mixed, either accidentally or by design, it is difficult to find these varieties pure. The reason for mixing the seed is that larger yields are usually obtained in this way than when each variety is grown separately. Nevertheless, as a general rule it is best to sow these varieties pure, especially if it is wished to obtain products answering to definite cultural requirements, or for some specific commercial purpose, such as seed-wheat for sale.

The Barletta wheat, so common some years ago, has since become considerably modified, although it is still the variety most grown and it can be obtained fairly pure. It adapts itself readily to the different climatic and soil conditions where it is grown, in the North and South of the cereal region ; its yield is sufficiently large, while the grain is of good composition and of high nutritive value.

Russian wheat shares these properties and has the further advantages of adapting itself better to lighter soils, resisting winter cold and suffering less from spring frosts. These characters, however, are modified and weakened by changed conditions and prolonged cultivation in surroundings differing from those obtaining in its native country, or wherever it has usually been produced.

The Italian or Lombard wheat has the advantage of being early and of yielding under similar conditions a much larger crop than Barletta. It can also be sown earlier, and as it ripens sooner than the latter, the periods over which sowing and reaping can be carried out are prolonged, a considerable advantage to the agriculturist. As the grains are shed easily it must be cut before it is dead ripe.

The Bordeaux or French wheat is beardless, and thus differs from the above-mentioned varieties; it also yields a good crop, but is more delicate than Italian and Barletta. The Bordeaux variety requires a soil of higher fertility, greater care in the preparation of the tilth and in cultivation as well as a situation sheltered from strong winds.

The Hungarian wheat is a bearded and hardier variety, adapted to light soils of mediocre quality; it is thus to be preferred in certain cases.

Tuzela and Richela are bearded varieties which are less common now than they were some years ago ; they share some of the characters of the French wheat. Mixtures of these varieties acquire the characters of both, though a little weakened.

Barletta and Russian wheats contain a high proportion of protein and are consequently more nutritive, while Italian and French contain a larger amount of starch and furnish the whitest flours ; but the dough made with the latter is less spongy and does not rise as well as that made from the wheats with higher gluten and glutenin content.

There are other soft varieties, like Rieti, that are similar in some respects to Italian or Lombard, although as a rule they are richer in gluten; Fucino resembles Barletta, but when pure produces larger grain. Under certain conditions, these wheats have furnished crops of such a nature as to encourage their cultivation; neverthless, they have not acquired the importance of Barletta, Russian, Italian and French. Rieti is also somewhat of a favourite in certain districts where Barletta also does well ; these two varieties have the same cultural requirements.

Saldomé is a fine bearded variety with light yellow rounded grain yielding a very white flour ; it was grown with success some years ago, but has been gradually given up, as the buyers for export did not care for it, on account, it appears, of the difficulty of collecting sufficiently large amounts to form complete cargoes.

For some years past, agriculturists have been talking with increasing enthusiasm of "hybrid" wheat, under which name they include the product first obtained in the Province of Córdoba, and later succesfully grown in different parts of the Province of Buenos Ayres and especially in the Pampa. There is really no question of its being a true hybrid wheat, as it is a mixture of Barletta, Russian, Italian or Lombard, Rieti and sometimes also Hungarian.

This mixture has furnished good crops from the commercial point of view, although from an agronomic standpoint they are not homogeneous. Owing to its yield being larger than that produced by any one of the varieties composing it when grown separately, it has attracted the attention of agriculturists, and its cultivation has rapidly increased. In somewhat light, rather shallow soils the so-called hybrid has proved very productive, while in the virgin soil of the Pampa it has acquired a distinct reputation on account of its yield and of the great bushel-weight, which reaches 68 or 69 lbs. We are dealing here with a commercial class of wheat and not with a new variety. It has not been obtained by crossing, as its original name would seem to indicate, and is therefore subject to all kinds of variations. In fact, the product varies according to the type of soil, the climatic conditions, soil fertility, the number of years the land has been in cultivation, etc. This wheat, which is now known by the name of Pampa, does not present any clearly defined characters; this is only what would be expected, considering the manner in which it has been obtained. So-called "hybrid"

wheats have been produced in the manner indicated above in the Provinces of Entre Ríos, Santa Fé, Córdoba and Buenos Ayres, as well as in the Pampa, and in fact wherever wheat is cultivated. The products of the Pampa, and especially those grown on virgin soil, have at present the most distinctly defined characters; these will, however, probably disappear, unless some effort is made to fix them by suitable methods of cultivation, a matter of some difficulty owing to the constant influence of the varieties contributing to their formation. It can, however, be done, as is proved by the numerous examples occurring in the history of cultivated plants.

Cultivation must be carried out in a systematic manner and on a very large scale. By proper direction and intelligent selection made according to genetic laws it will be possible after some generations to obtain a constant type. At present the wheat incorrectly called "hybrid" is not a well defined variety but a commercial type similar that to produced in the holds of Transatlantic liners when good wheats belonging to the Barletta, Russian, Italian, Rieti, French and other varieties are shipped together.

The cultivation of this wheat can be recommended especially in places where it has already given satisfactory results, and generally wherever the yield of the other kinds of wheat decreases owing to soil exhaustion or other causes.

The mixture of different varieties of wheat, as well as that of other varieties of plants, invariably increases the yield; it is therefore not surprising that similar results are obtained in the case under consideration.

From the point of view of the chemical composition, this wheat contains a large proportion of those substances considered most valuable in bread-making; its great weight per bushel ensures it a good place on the market.

The purity of certain products, and especially that of wheats, is only of relative importance, and must not always be exacted to the extent of rejecting mixtures, especially if the soil is more suitable to their cultivation, or if they command higher prices and are also preferred by the miller. It is apparently an erroneous application of agricultural precepts to rank purity above all other qualities and to demand it in every product irrespective of circumstances.

It would be a serious mistake, both agriculturally and economically, to enjoin the cultivation of mixed wheat throughout the whole cereal-growing region of Argentina, but it would also be a great error to discountenance it absolutely under the pretext that such an impure or mixed product should be considered inferior to others that are pure. Provided that it is of good quality, the cultivation of this wheat is to be recommended.

As regards the hard varieties, Candeal and Taganrog, the former is preferable for the beauty of its grain and its chemical composition, but the latter has the advantages of greater adaptability and higher yield. Hence the Taganrog variety is more widely distributed and is usually preferred by growers, as they are surer of the results.

Pure Candeal costs more than Taganrog, as, owing to its composition, it yields flour suitable for making the best quality of bread.

The cultivation of hard wheats is not much developed in Argentina.

though there is the possibility of its extension; as the market for hard varieties is a smaller one, any surplus immediately affects the prices, the fluctuations often being considerable. It is especially necessary to endeavour to preserve the purity of these varieties, for they easily degenerate and acquire the characters of soft wheats, undergoing a considerable decrease in value in consequence. We have here the exact opposite of what we have found in the case of soft wheats; in that of hard varieties *purity* is a *sine qua non*, and all the efforts of the cultivator should be directed towards preserving it by giving the necessary attention to sowing, cultivation and harvesting. However, not much harm results in mixing together different varieties of hard wheats.

The growing of different varieties of wheat not only has the object of meeting differences in the composition of the soil and climatic variations, but it also allows sowing, cultural operations and harvesting to be spread over a longer interval; in this way a more extensive area under wheat is obtained than if only one variety were cultivated.

The Barletta variety is adapted to the whole of the cereal-growing region of Argentina, although it is unwise to take the seed of this wheat from South to North without adopting the necessary precautions for minimising the influence exerted by the difference of latitude and thus ensuring the success of the crop. The Russian variety is the one that best suits the southern zone of the cereal region, although it is also acclimatised in the northern zone, in the provinces of Córdoba and Santa Fé. The Italian wheat does well in the northern zone, when sown early; the French variety is more adapted to the rich soil of the central corn-growing district. The hard wheats Candeal and Taganrog do well in the northern and central portions.

In addition to the wheats already mentioned, other varieties are grown (especially in the northern provinces, beyond the cereal region) which seem to answer better to the special conditions obtaining in these districts. They are known under different names, usually reminiscent of their origin, and are usually only cultivated over a small area. Various experiments have shown that these varieties do not give equally satisfactory results in the cereal-growing region. They are, further, of little importance, although useful in the places where they are grown.

Vine Growing in Italy

by

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After the union of Italy had been accomplished and the country began the reorganisation of its rural resources, the question of vine-growing also gradually received some share of attention; this industry, with few exceptions, was in a deporable condition. The practice of vine selection was begun, new vines were imported from France and Germany, while special Ampelographical Commissions were instituted, and propaganda carried out by means of exhibitions, congresses, publications and scholarships. Further, the creation of enological institutions was encouraged and a Royal Enological School, as well as the special Royal Schools of Viticulture and Enology, were founded.

Gradually the amount of wine produced began to increase, and the area under vines, including vines mixed with other crops, which in the five-year period 1870-1874 was 4 761 477 acres, reached 7 648 912 acres in the period 1879-1883 and then, increasing by degrees, rose to 10 763 500 acres in 1913 (of which 8 566 700 acres were mixed and 2 196 800 acres vines alone), in spite of the phylloxera which first appeared about 35 years ago.

The chief impetus to vine-growing in Italy was given by the destruction of the French vineyards by phylloxera; after the commercial treaties with France were cancelled, there was a period of check, but the industry showed renewed vigour as a result of the customs facilities granted by Germany and Austria, the discovery of new markets and the improved relations with North and South America.

Another great encouragement was given to viticulture in Southern Italy (Apulia, Sicily and Sardinia), by the increased wine trade with Upper Italy during the unfortunate period 1884-1888, when owing to lack of control, or to mistaken method, phylloxera was rife.

In 1913, the area under vines amounted to 3 214 000 acres in the plains of the peninsula, chiefly in the great valley of the Po; 4 039 800 acres in the hilly region of Northern and Central Italy and in portions of the Abbruzzi, Molise and Campania; while in the mountainous districts of the Alps and Apennines, the vineyards covered 1 312 900 acres. They extend to different heights according to the latitude, *viz.*, from 1300 or 1600 ft. above sea-level in Northern Italy to 2 000 ft. or more in the centre of the country and even 3000 ft. in Sicily.

The area under vines alone is divided as follows: 59 705 acres in the plains, predominating in the South and the Islands; 1 298 100 acres in the hills, of which 770 750 acres are in the Peninsula; 345 000 acres in the lower slopes of the mountains; and the remainder in the mountain districts proper.

TABLE I. — *Vineyards in Italy: Area and Production in* 1913

Regions	Total area cultivated in 1870-1874	Area cultivated in 1913			Total wine production in 1913	Total production of grapes, average 1909-1913		Average production of grapes per acre		Average quinquennial production of wine per acre	
		mixed vineyards	pure vineyards	total		mixed vineyards	pure vineyards	mixed vineyards	pure vineyards	mixed vineyards	pure vineyards
	acres	acres	acres	acres	thousand gal.	tons	tons	lbs.	lbs.	gallons	gallons
Piedmont	289 870	567 400	152 200	719 600	159 900	631 900	259 700	2 494	3 822	169.4	259.7
Liguria	109 536	114 400	15 600	130 000	18 350	75 600	28 200	1 479	4 049	98.7	275.2
Bombardy	370 056	275 300	106 000	381 300	57 030	185 100	147 000	1 505	3 105	100.6	210.7
Venetia	600 456	1 647 000	76 900	1 723 900	66 620	391 900	80 900	533	2 358	36.0	160.0
Emilia	416 294	2 053 300	52 600	2 105 900	133 110	779 300	75 400	849	3 199	59.3	217.9
Tuscany	547 168	1 486 900	40 300	1 527 200	101 220	529 600	75 900	798	4 220	54.1	286.3
The Marches	392 640	930 600	13 800	944 500	48 730	324 900	31 500	782	5 124	53.0	352.5
Umbria		542 400	9 100	551 600	23 550	174 000	15 700	717	3 834	48.6	260.2
Latium	108 720	206 800	94 400	301 200	58 670	161 300	182 200	1 746	4 322	118.4	293.3
Abruzzi and Molise		172 200	143 600	315 800	45 930	80 400	199 000	1 043	3 105	70.9	210.7
Campania		563 400	119 100	682 500	147 860	502 900	222 600	1 999	4 193	135.6	284.0
Apulia	*1 345 426	—	697 850	697 850	141 410	—	809 700	—	2 602	—	176.6
Basilicata		28 200	49 200	77 350	12 000	21 300	50 500	1 658	2 300	112.5	159.0
Calabria		500	99 100	99 600	18 550	400	137 700	1 784	3 121	121.3	211.1
Sicily	522 533	2 200	412 200	414 400	103 380	2 080	690 000	2 079	3 776	134.7	256.1
Sardinia	59 767	—	114 900	114 900	13 470	—	118 100	—	2 302	—	156.2

* Total in 1913, 1 873 100 acres under vines, *viz.* 764 300 acres mixed and 1 108 800 acres pure.

The accompanying table gives a more detailed account of the area under cultivation in the different regions and its production ; it seemed to me advisable to add a column giving the area under cultivation during the five-year period 1870-74. I have also added other columns showing the average quinquennial production of wine per acre, taking as a basis for calculation the official standard : *i. e.* that on an average 1000 lbs. of grapes produce 68 gallons of wine. I have chosen the year 1913 rather than 1914 because, also according to the official data, the vintage of the former year was an average one.

On examining the average quinquennial production per acre, we find that in mixed vineyards the official data show a yield of 1010 lbs. of grapes per acre, equivalent to 68.5 gallons of wine, and in pure cultivation 3175 lbs. of grapes, equivalent to 215.75 gallons of wine. These averages are too low if they are taken at their right value, especially in the case of vines in pure vineyards. Calculating the average yield on this basis, vine-growing would have to be regarded as a very poorly paying industry and in some cases as a source of loss, and this it certainly is not.

Viticultural economy. — The grape crop in Italy is too much affected by climatic conditions, so that gluts are often soon followed by shortages. Less fluctuation would be caused on the market if the wine trade were so organised (a start has already been made, albeit a slow one) that the surplus from the periods of over-production could be accumulated and kept to supplement the deficiencies of years when the vintage is scanty. This, however, requires an anticipation of preliminary outlay and circulating capital which the industry is not yet able to meet.

The official statistics assign to Italy for the last five years an average production of 1 013 million gallons of wine; but, both for the reasons already given, and because in actuality the period of investigation is too short, this falls far short of the true average ; it is only necessary to go a few years back to find an increase.

TABLE II. — *Total production of wine from* 1907 *to* 1914.

	million gallons
In 1907 (1)	1760
» 1908 (1)	1694
» 1909	1360
» 1910	645
» 1911	937
» 1912	971
» 1913	1150
» 1914	946

(1) The figures referring to 1907 and 1908 differ from those given in the old statistics ; they have been calculated by *Carlucci*, Central Inspector of the Ministry of Agriculture, allowance being made for the difference between the area attributed to vines in the preceding statistics and that actually given in the recent agricultural survey.

The average for this period gives a production of 1182 million gallons, which for the above mentioned reasons I still regard as being below the true amount.

The price of wine varies, naturally, with the conditions of production. If we turn to the official data, it would seem that the average price in 1912 was 36.23 lire per hectolitre, and in 1914 was 30.08 lire, which is higher than that of the preceding years when it stood at about 20 lire. Thus, without being far out, we may reckon the average price of the wine sold during the last eight years at 25 lire per hectolitre (£4 10 *s* per 100 gallons).

Hence, wine would represent an annual return of 1344 million lire (53 millions sterling); if to this sum were also added the value of the grapes consumed as fruit and that of the residues of wine-making, it would be no exaggeration to assign to Italian viticulture a total return of 1400 million lire (55 millions sterling). This industry thus occupies the second place in Italian agricultural economy, the following figures being given for other crops (in million lire): *wheat* 1298 ½, *oats* 106, *potatoes* 115, *maize* 450, *rice* 105, *forage crops* 1645, *oil* 288, *citrus fruits* 75, *various fruits* 170, *chestnuts* 117.

It is easy to understand how much importance this industry assumes in the economy of labour, when we consider that an acre of unmixed vineyard requires annually 48 to 60 days of work and a mixed one, not including the labour devoted to the inter-crop, 8 to 12 days. This gives no less than 206 817 500 working days, a return to the working classes of at least 413½ million lire (16½ millions sterling) per annum.

The outlay of capital required by the Italian vineyards is enormous; it cannot be less (apart from the value of the land) than 6130 million lire (243 million *l*), while the working capital necessary for the wine-making industry (buildings for wine-making and storing, casks and machinery), amounts to about 7 330 million lire (291 million *l*).

If we wished to carry our investigations further, it would be necessary to calculate the sum needed for the indispensable requirements of the wholesale and retail wine trade and also what constitutes the dead capital of wine-making, *i. e.* distillation, manufacture of the cream of tartar, etc.; but this would be to exceed the bounds of this article.

The phylloxera question. — A very serious danger now threatens this great source of wealth — the phylloxera. Sicily was the first to suffer the ravages of this insect; this island, whose average yield of wine had reached more than 175 million gallons, saw within a few years the ruin of the vineyards upon which had been expended the savings of its whole population, both rich and poor. It was a time of misery, of discord and emigration, but energetic reaction succeeded the initial period of discouragement; the Government did its best to encourage the vine-growers and to instruct them. It directed their attention to the rapid reconstitution of the vineyards with American stocks, establishing numerous nurseries from which private individuals could obtain the necessary material gratuitously and instituting demonstration vineyards all over the island. The Government also organised numerous and frequent lectures, classes in vine-grafting

(encouraging the workers to take part by means of numerous prizes), and the distribution of grafting knives, illustrated publications dealing with the insect, American vine-stocks, etc. At the present time, the reconstituted vineyards in Sicily cover nearly half a million acres ; every year wide areas are planted up, especially those previously down to pasture, in order to take advantage of the fiscal benefits offered by the recent land register. The funds necessary to carry out so great an undertaking were for the most part provided by savings accumulated during temporary emigration. A praiseworthy example in this respect is afforded by the district of Marsala, which now no longer needs to buy wine from without; on the contrary, it is even threatened with over-production.

Phylloxera is now widely spread in Italy; but outside Sicily and Sardinia, the injury caused by it is relatively slight, even in regions in which it has been known for some decades, as Lombardy, Piedmont, Liguria and Tuscany. The invasion of Apulia is disquieting, but both the Government and private individuals have displayed great activity in devising preventive measures, and it is to be hoped the danger will prove less formidable than was expected.

The figures relating to the statistics of phylloxera infection, though indicating the extension of the disease, do not indicate a corresponding increase in intensity.

In 1914 there were as many as 53 provinces invaded, with 3228 communes infected or suspected as against 3747 vine-growing communes immune. It is reckoned, but the estimate is only based on probability, that from 1879 to the present day, phylloxera has destroyed about 1 ½ million acres, chiefly consisting of pure vineyards in the hotter parts of the country, while half a million acres of vineyard have been reconstituted on American stocks. As we have seen, however, the extent of land under vines is increasing almost continuously ; this means that as the phylloxera destroyed the vineyards in one place, others were gradually planted on ground previously used for crops of a different kind.

As has already been noticed, the Government displayed great activity in combating phylloxera, at first by methods aiming at the destruction of the insect, and subsequently by the widespread distribution of American vines. In fact, in addition to the vineyards belonging to the Royal Practical and Special Schools of Agriculture, others are to be found in nearly every province, which are the property either of the Government or of local bodies; these produce annually some millions of grafts and rootlings for free distribution. When necessary, considerable quantities are also procured from abroad, especially from France, and these also are given gratis to private individuals. In addition, there are numerous nurseries run on commercial lines ; these are usually under capable management and American stocks are sold at very moderate prices.

However, the Government is by degrees dissociating itself from the work of phylloxera control, or at least endeavouring to act merely in an indirect manner by entrusting the matter to private effort and starting

special societies of vine-growers, associated in the so-called *Compulsory Antiphylloxera Consortia* which are doing really useful work.

At the present time Italy possesses 157 such *consortia* and some others founded by private initiative (Cuneo and Marsala). It was these private *consortia* consisting of a few energetic, capable volunteers, which showed what success could be attained in this direction by the association of the various forces of a country. To the Piedmontese Antiphylloxera Consortium and to those of the Cagliari district, Florence and Marsala, is especially due the signal merit of having inspired the authorities with the idea of making these societies compulsory, wherever the majority of the vine-growers were in favour of such a step.

The Ministry of Agriculture retains the chief supervision of these institutions by means of Royal Commissioners, in order to secure unity of work and of control.

When the consortium has been formed, either by the voluntary decision of a quarter of the vine-growers who possess at least one-third of the vineyards or on the initiative of the Prefect after consultation with the various administrative organs and the Commission for the diseases of agricultural plants, every member has to make an annual contribution not exceeding 4*d* per acre of vineyard, those persons possessing less than an acre being exempt; the contribution must be paid on the basis of the provisions regulating the collection of direct taxes.

The functions of these consortia are many and varied. They are responsible for precautionary methods; the actual control of the pest; the formation of nurseries of vines resistant to the parasite; the diffusion, by means of printed matter and conferences, of information respecting the insect itself, American stocks, etc. Some consortia act as agricultural syndicates for the acquisition of the raw material used in vine-growing; many have already undertaken important experiments on the adaptation of the different species of American vines to climatic and soil conditions, on forcing grafts, on their affinity with the native vines and on hybridising. Sicily soon followed France in realising the necessity of creating new stocks uniting the properties of phylloxera-resistance, adaptability to the climate of Italy (so different from that obtaining in the native country of the pure varieties), adaptability to calcareous and dry soils and capacity for producing grapes suitable for the manufacture of wine. GRIMALDI, PAULSEN, RUGGERI and others have been working patiently on this subject, which is bristling with difficulties, and we now possess various American × Sicilian hybrids whose phylloxera resistance has been tested for a sufficiently long period, while their adaptability and productiveness have already attracted the attention, not only of the Sicilian vine-growers, but also of those of Tunis, Algeria and Spain. In Sardinia, too, at the Royal School of Viticulture and Enology at Cagliari, similar researches were begun, perhaps earlier than in any other part of Italy, but for various curious reasons the work came to nothing.

Thus, the new viticulture in Italy is under excellent and promising direction.

The enological industry. — The Italian wine-making industry has made really noteworthy progress and the organisation of the wine-trade is improving along very sound lines and acquiring a national character. At the present time Italian wine has acquired a reputation on the markets of the world; if the export trade has not yet assumed the proportions corresponding to the development of viticulture, this is chiefly due to the heavy duties imposed by those countries which ought to offer the best openings for the products of our wine-making industry. It is true that our light wines find formidable competitors in those supplied by France, our blended wines have to contend with the products of Spain and our fine wines with those of France and Germany, but it is also a fact that our wine trade has now acquired a firm footing and this is the index of our enological progress.

Formerly the only products accepted abroad (and these only found a limited number of customers) were *Vermouth,* a little *Barolo, Barbera* and *Gattinara* in the case of Piedmont; while the wine-trade of Lombardy was restricted to a small quantity of *Valtellinese* (Val d'Inferno, Sassella, Groppello), which went to Swizerland; a little Ligurian wine (especially *Vermentino*) was exported to France and America, while Venetia sent to Austria a small amount of *Raboso, Prosecco,* and *Valpolicella* for the use of the Italian population beyond the frontier. *Chianti* (from Tuscany) was appreciated, but not as much as it deserved, being exported to England and sometimes to America. The products of Southern Italy were little known; Sicily exported its *Marsala, Moscato di Siracusa, Moscato di Pantelleria* and a little *Malvasia di Lipari*; Sardinia sent to England some rare samples of its wonderful *Nasco,* its dry *Malvasia* and its delicate, aromatic *Vernaccia,* and this was all.

Then came the phylloxera years in France, the seasons of bad vintages in Austria, our increased emigration, and the growth of our political influence; there arose a demand at reasonable prices for first our blended, and later our ordinary, wines. Gradually, also, fine bottled wines made themselves known, and side by side with those already familiar, the products of Southern Italy found a place: theVesuvian vintages with their classic names, *Falerno, Vino di Pompei, d'Ischia, di Capri*; the products of Latium under the name of *Genzano.* A new industry also made its appearance, which at the present juncture deserves special attention: the sparkling wines that opened up new fields of activity to Piedmont, Venetia and Central Italy. As a secondary branch of the trade the manufacture of non-alcoholic wines, concentrated musts and cognac was begun, but so far only with limited success.

The export trade is developing slowly; in 1871 it reached 5 350 400 gallons; in 1880, it had risen to 48 541 000 gal. and it attained its highest point, 79 290 000 gal. in 1887, on the eve of the dissolution of the commercial treaty with France. The rapid depression that followed was only transitory, since in 1897 the amount of Italian wine sold was 53 902 200 gallons. A second period of decline occurred about 1900, but towards 1906 matters gradually improved and since then the figures have been fairly

satisfactory, although far from as high as in the years 1880-87. As may be seen, our wine trade suffers from periods of fluctuation which it is difficult to remedy, for the present at any rate.

During the last two years our foreign sales were as follows :

		1913	1914
Common wine in cask	gallons	32 278 400	39 347 400
Wine in flasks and demi-johns	»	1 620 740	1 391 980
Marsala in cask	»	631 724	427 460
» in bottle	hundreds	3 966	2 939
Sparkling wine in bottle	»	5 358	3 412
Fine wines in bottle	»	41 081	38 448
Vermouth in cask	gallons	754 777	620 192
» » bottle	hundreds	133 598	103 643

The total value of our exports in 1913 was £ 3 274 783, and in 1914 £ 3 405 314, the figures for 1914 being therefore higher than those of the preceding year, in spite of the bad effect of the European War upon the export of kinds such as Marsala, sparkling wine and Vermouth.

Our best customers. — In 1914, France was our best customer for ordinary wines, 9 550 900 gal. being sent to that country, although this market had appeared closed to our wines after the adoption of the new Customs tariff. Switzerland took 15 255 800 gal., Brazil 2 450 700 as against 3 627 700 in 1913; the exports to Germany rose from 1 027 580 gal. to 2 614 010 and those to the United States from 1 740 030 gal. in 1913 to 2 210 450 in 1914, while the supply sent to Argentina fell from 3 244 600 gal. to 1 937 200. Austria set her face wholly, or almost wholly, against all importation of wine, with the idea of using only her own products; however, she continued to purchase Marsala, of which 30 152 gal. were forwarded in 1913 and 30 725 in 1914. Our exports of fine wines to the United States only increased to an insignificant extent : 185 600 bottles were exported in 1914 as against 184 400 in 1913. The trade of wine in flasks (" fiaschi ") was slightly on the increase in almost all the countries of America, except Brazil, where it fell from 320 737 gal. in 1913 to 101 505 in 1914, and in the United States, where it fell from 308 456 gal. to 138 811. This decrease is not a serious matter, being only temporary. The sale of Vermouth diminished a little everywhere, except in Great Britain and the United States, in which countries it rose respectively from 81 675 and 42 345 gallons in 1913 to 101 920 and 56 981 gallons in 1914. A notable decrease in the sale of bottled Vermouth is recorded in Argentina, Brazil and the United States.

With regard to this, however, one fact must be borne in mind. Some of the most important firms manufacturing and dealing in Vermouth, in order to avoid the very heavy duties of certain States, imported the raw material in the form of unrefined wine and extracts, buying on the spot the necessary alcohol and sugar, and manufactured local Vermouth, instead of importing it from the mother-country. This is also the case with sparkling muscat in the United States.

Institutions for the promotion of instruction in viticulture and enology. — In little more than forty years the vine-growing and wine-making in-

dustry of Italy made remarkable progress. The latter began with the founding of a Royal School of Viticulture and Enology at Gattinara, subsequently transferred to Asti ; to this School was entrusted the scientific study of the wine-making industry. Later were established the Royal Schools of Viticulture and Enology of Conegliano (Venetia), Avellino (Campania), Catania (Sicily), Alba (Piedmont) and Cagliari (Sardinia). Some of these have two courses: one for instructing the technical cellarmen, the other for the directing Staff. The Royal Schools of Phytopathology at Pavia and Rome were given charge of the investigation of vine diseases. The experimental cellars of Arezzo, Barletta, Milazzo, Noto, Riposto and Velletri were entrusted with the duty of showing by actual demonstration the changes to be adopted in the methods of preparing and storing wine. In addition to the provincial and district travelling chairs founded by private initiative, Royal Special Travelling Chairs of Viticulture were established at Castellamare, Osimo, Piazza Armerina and Velletri.

With a view to organising the Italian wine trade and affording guarantees as to the qualities and genuiness of the products, a number of special delegates (Royal Enologists) were sent abroad. These have done excellent service in Germany, Austria and Switzerland, and are at the present time very useful in Latin America and the United States. Their work is manifold and varied and always useful, even when limited to informing the Government and the Mother-country of the prevailing conditions, legislation and commercial requirements in the countries where they are stationed. Wine exhibitions were organised in Switzerland, Belgium, Germany and Argentina, for the purpose of making our finest wines better known to, and more appreciated by, merchants, hotel-keepers and consumers. A law against adulteration of wines, while avoiding extreme measures that might engender unjust distrust without being of any practical benefit, regulates and superintends the production and sale in the country. When the mechanism for enforcing this law is more fully developed, it will be more than sufficient to safeguard the interests of the consumers and to uphold the dignity of the very important industry with which we have now dealt.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

671 – **Report on the Progress of Agriculture in India for 1913-1914.** — COVENTRY, B. (Agricultural Adviser to the Government of India), 81 pp. Calcutta, 1915.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

An account of the work of the Agricultural Institute at Pusa since its foundation by Lord Curzon in 1904 and of the progress of Agriculture in India during 1913-14.

The institute at Pusa now contains a staff of over 112 officers and has passed out 229 students as specialists in various branches, in addition to publishing a total of 97 research memoirs and 48 bulletins. The more important works carried out by the Institute include an account of the wheats of India, the working out of the inheritance of the varietal characters of Indian wheats on Mendelian lines and of the influence of environment on milling and baking qualities; the establishment of the economic significance of natural cross-fertilisation in cultivated crops; experiments on the availability of phosphates and potash in Indian soils, the loss of water from soil during dry weather, the water requirements of crops and records of the constituents of drainage water; an account of the insect pests of India and the locust problem in the Bombay Presidency; investigations on the more important crop-pests and the working out of remedies; investigations into the more important subjects of soil bacteriology and of the role of bacteria in the fertilisation of Indian soils; the study of crop diseases throughout India and the application of remedial measures (work which has saved the Palmyra industry in the Madras Presidency); investigations into the saltpetre industry; studies of various types of Indian tobaccos and critical examinations of various Indian crops such as: gram, rape, mustard, pigeon pea, fibre

plants, etc.; study of effects of improved cultivation and of the use of improved implements; the establishment and improvement of one of the best breeds of Indian cattle ; the publication and dissemination of the results and correspondence relating to Indian agriculture. In addition to this should be added the work of the Veterinary Research Laboratories at Muktesar on the diseases of cattle and prophylactic and curative serums and vaccines. By means of this work the staff has gained a world-wide reputation and the Institute has established its position among learned institutions.

The chief features of the development of Indian agriculture during the year are as follows : the introduction of steam tackle for cultivation ; the establishment of two herds of milking strains of the Ayrshire-Montgomery cross as part of a scheme for the improvement of dairy cattle in India; the storage of sugarcane in clamps and the growing of sugar-beets in the Peshawar Valley, thus giving greater continuity to a factory; investigations on the relation between carbonic acid in soils and the amount of lime and magnesia in solution; extension of the cultivation of the new hybrid wheat No. 12 in the Gangetic plain and on the black soils of the Deccan ; investigations on the disease of Java indigo and improvements in the industry ; experiments on surface drainage resulting in improving the cropping power of soils in Bihar, the equipment of an Experiment Fruit Station at Quetta in Baluchistan; determination of the cause of *Ufra* disease of rice and remedial measures; methods for the control of red rot of sugarcane and the determination of the causes of three previously undescribed cane diseases; investigations on wilt in cotton, and sesamum and potato blight; improvements in green manuring in dry soils by soaking the green manure in pits before applying; investigations of soil toxins and the measurement of toxicity by means of the rate of CO_2 evolution ; investigations of the organisms concerned in the fermentation of rice beer and the value of *Aspergillus oryzae*.

With regard to the development of cotton growing considerable difficulties arise in the organisation of seed distribution, in the supply of pure seed, in the prevention of adulteration of both seed and lint and in the building up of confidence on the part of buyers and spinners. Strains of improved quality, unless also possessing greater cropping power, are not readily adopted by the native cultivators owing to the difficulty of realising the increased value for the produce.

A sugarcane-breeding station has been established at Coimbatore and great variations have been found among the various strains raised from seed. Stations for testing varieties are being established in various provinces and encouragement is given to the establishment of pioneer sugar factories on a large scale, two of which are already working. In addition to improvement in the cane-sugar industry attention is being paid to sugar from other sources, such as that from sugar-beets and date palms.

The introduction of foreign varieties of groundnuts has resulted in an enormous extension of the area under this crop, the whole of which is consumed locally. In addition to its commercial value the crop is a valuable addition to the rotation in increasing the yield of wheat.

672 – **Agriculture in Russia in 1913.** — From data contained in the "Statistical Economical Yearbook of Agriculture in Russia and Other Countries", in *Isviestiia Glavnago Upravleniia Semleoustvoistva i Semledieliia* (Intelligence of the General Direction of Land and Agricultural Organisation), No. 7, pp. 164-168. Petrograd, 1915.

The year 1913, which closes the epoch before the war and the prohibition of the sale of alcohol which followed immediately upon the outbreak of war, represents the division between the agriculture of the past in Russia and that of the future and will certainly be used as the basis of all studies and researches of a statistical and economical nature on agriculture in Russia. The following is a summary of the most important and characteristic data of the year.

From the appended table it will be seen that the area under cultivation in 1913 has increased, as it had in previous years also.

Year	Seeded area in thousands of acres
1909	261 585
1910	269 089
1911	273 767
1912	270 315
1913	282 988

The greatest increase in the area sown occurs in Asiatic Russia : from 25 118 000 acres in 1909 to 33 360 192 in 1913, that is to say an increase of 33 per cent ; in the 50 provinces of European Russia this increase in the same time has been only 4.4 per cent.

At the same time that the acreage under cultivation has increased, the yields have also increased. Thus in 72 provinces and regions of the Empire the crops rose to 123 209 000 tons in 1913 as against 95 965 000 tons for the average of the five years 1906-10.

The data for 1913 also confirm another very important fact, which was recorded in the preceding Yearbook, and which consists in the continual increase of yield per unit of area, as the following table of the average crops shows :

TABLE I. — *Yield, in lbs. per acre.*

Year	Rye		Spring wheat		Barley		Oats	
	Peasant farms	Large estates	Peasant farms	Large estates	Peasant farms	Large estates	Peasant farms	Large estates
1901 to 1910	669	716	602	682	682	762	669	776
1910	749	769	629	736	749	716	703	729
1911	642	762	602	669	682	749	669	703
1912	716	863	655	736	736	716	749	769
1913	776	836	709	703	769	850	743	863

The small crops of 1911 are due to the fact that it was a bad farming year.

Among the signs of the agricultural progress of Russia, the increase of the area devoted to potatoes and of their yield must also be recorded, as it proves that the systems of cultivating the land have improved. Thus in 72 provinces and regions of the Empire during the five years 1906-10, the area under potatoes was estimated at 10 561 000 acres, and the total average crop at 30 080 000 tons, whilst for 1913 the respective figures were 11 916 500 acres and 35 013 000 tons.

Table II gives a comparison of the production with the exportation of the most important cereals during the five years 1910-1914.

TABLE II. — *Production and exportation of cereals.*

Crop	Year	Yield in thousands of tons	Exportation	
			in thousands of tons	percentage of yield
Rye	1910	21 650	645	2.9
	1911	19 022	854	4.0
	1912	26 035	484	2.8
	1913	24 696	629	2.5
	1914*	21 473	(371)	(1.7)
Wheat	1910	20 715	6 029	29.0
	1911	13 606	3 869	28.0
	1912	19 280	2 579	13.0
	1913	25 502	3 272	13.0
	1914*	20 765	(2 369)	(12.0)
Oats	1910	14 928	1 322	8.9
	1911	12 252	1 370	11.0
	1912	15 250	822	5.0
	1913	17 507	596	3.0
	1914*	12 638	(274)	(2.0)
Barley	1910	9 930	3 933	39.0
	1911	8 860	4 224	47.0
	1912	10 027	2 708	27.0
	1913	12 267	3 869	32.0
	1914*	8 479	(1 951)	(23.0)

* The data as to exportation embrace only 11 months.

From the above table it will be seen that among the cereals only wheat and barley are really important from the point of view of exportation. The place occupied by Russia in the grain market of the world is best shown by the exportation of wheat. During the five years 1908-12 the exports from Russia and the other wheat-exporting countries were as follows :

	In thousands of tons					
	1908	1909	1910	1911	1912	1913
Russia	1 435	5 062	6 029	3 869	2 595	3 272
Argentina	2 063	2 515	1 870	2 273	2 579	—
Canada	1 193	1 338	1 354	1 241	1 741	2 531
Australia	451	870	1 321	1 531	935	—
United States	2 724	1 822	1 257	645	806	2 483

Among the above countries the one which competes most with Russia is Canada, where the area under wheat is increasing very rapidly. In 1901 it was 4 081 000 acres, while in 1913 it had risen to 11 017 000.

The area sown to wheat in Argentina, Australia and the United States does not change much, sometimes increasing and sometimes diminishing.

The prices of grain fell somewhat during 1913, whilst the wages of farm hands rose in comparison to those current during the preceding year; thus the year 1913 was not so favourable to Russian farmers as 1912 had been.

Live-stock breeding has diminished to a noticeable extent in European Russia. While the statistics of 1899 estimated the number of cattle at 38 millions, in 1912 it had fallen to 32.9 millions. The number of sheep and pigs is also smaller.

The amount of live stock in Russia as compared with that of other countries is shown by the following table, in which the number of head of live stock per 100 inhabitants is given.

Country	Live stock			
	horses	cattle	sheep	pigs
Russia-in-Europe	17.8	24.9	31.8	10.1
Siberia	48.1	57.9	50.8	11.4
Central Asia	44.4	48.4	194.5	1.0
England	4.1	25.9	60.0	7.2
France	8.2	37.4	40.9	17.8
Germany	6.9	32.1	8.4	39.2
Austria	6.3	32.1	8.5	22.5
Hungary	11.3	35.0	40.9	36.3
United States	22.5	60.6	55.1	63.1

As regards vine growing, in 1913 there were 675 000 acres of vineyards, which produced 50 853 000 gallons of wine. The price of wine varied from 4½*d* to 6*s* 3*d* per gallon. Taking the average at 14*d* to 19*d* per gal., the value of all the wine produced in the Empire is 3 to 4 millions sterling. If the sale of alcohol is to be permanently forbidden, vine growing in Russia will be seriously injured.

Among exports of animal produce, that of butter and eggs increased in 1913. While in 1912 71 768 tons of butter and 3 396 millions of eggs were exported, the corresponding figures for 1913 were 76 346 tons and 3 572 millions. Further it must be noted that the meat exports increase continually; formerly they never exceeded 9 350 tons, but in 1910 they rose to 11 526 tons, in 1911, 13 315 tons, in 1912, 19 474 tons and in 1913, 20 312 tons.

Among the imports the increasing quantities of chemical manures are worthy of note. In 1908 they were 161 200 tons and in 1913 they had risen to 548 100 tons. The imports of agricultural machinery have rapidly fallen off, for from a maximum of 177 325 tons which was reached in 1912, they fell to 127 352 tons in 1913. This decrease is probably due to the fact that the Russian agricultural machine industry, which is steadily developing, has begun to compete successfully with foreign makers. According to the data given by the Yearbook, the home output of agricultural machines was estimated at £ 5 564 000 in 1912 and at £ 6 150 000 in 1913. The value of agricultural machines imported from abroad was £ 6 288 500 in 1912 and only £ 4 936 000 in 1913.

In conclusion, it may be said that the year 1913 was a satisfactory year for Russian farming, considering that the acreage under crops had continued to increase, as well as the yields per unit of area, both in the peasants' farms and on the large estates. The fact that agriculture in Russia is making constant progress is confirmed also by a number of indirect signs, among which the chief are : *a*) the increased production of potatoes, which is intimately connected with the improved methods of farming and cannot be considered in connection with the distillation of alcohol ; and *b*) the increased consumption of chemical fertilisers and increased use of improved agricultural machinery.

RURAL HYGIENE

673 – **Studies on Pellagra**. — I. Tizzoni, G. On the Infectious Nature of Pellagra : Results of Investigations in Italy and in Bessarabia. — *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 13, pp. 398 -400. Paris, March 29, 1915. – II. Nitzesco, J. V. Studies on Pellagra : Research on the Feeding of Animals exclusively with Maize. — *Comptes Rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXVIII, No. 8, pp. 212-224. Paris, May 14, 1915.

I. — The observations made by the writer in Bessarabia, Russia, in 1914, have demonstrated persistently in 17 new cases, the presence of the micro-organism described by the writer under the name of *Streptococcus pellagrae* in the blood of patients and sometimes in the cephalo-rachidian liquid and in the tissues. These results confirm those previously obtained by the writer in upwards of 150 observations carried out in Bessarabia ; they are also identical with those he obtained in Italy.

" There are cases of pellagra which certainly have no connection with maize poisoning, either because the quantity of maize ingested has been too small to produce poisoning or because too long a period (10 years) has elapsed between the use of maize as food and the outbreak of the disease. "

The pellagra germ is polymorphous, being variable in both its morphological and biological characters. The variations are mostly connected

with the period (ascending or descending) of the disease, with the composition of the nutritive substratum and with other causes which are still unknown. In certain cultures it is possible to follow all the transition phases from one form to another, so that the unity of the species can be affirmed beyond any doubt.

In severe forms of pellagra, very common in Russia, polymorphisim is more frequently observed than elsewhere. A whole series of observations on the behaviour of cultures of pellagra germs from Russia, including the spontaneous reversion to ancestral types and the frequency of the bacillus type, show that in that country the pellagra microbe is nearer the original stock, from which it may be inferred that the disease is more recent in Bessarabia than in Italy.

II. — In a preceding note the writer demonstrated the presence of zeinolytic ferments in the blood of victims of pellagra, and he has advanced the hypothesis that the penetration of zein into the blood is facilitated by digestive troubles. Maize very probably contributes to the production of these troubles, especially when it forms the bulk of the food and is eaten in large quantities.

In further research carried out at the Physiological Institute of Bucharest, and here summarised, the writer was able to obtain experimentally the production of these ferments in animals fed exclusively on maize. From his experiments, which were conducted on dogs (the nutrition of which closely approaches that of man) he concludes :

1. Zeinolytic ferments are found in the blood of dogs fed exclusively on maize for a period of at least three months ; this proves their poisoning by zein.

2. The digestive troubles which accompany an exclusive diet of maize must facilitate the penetration of intact zein into the blood. These troubles, as well as those of general nutrition, are very probably due to the insufficiency of maize as food, its protein being without tryptophane and containing only a small quantity of glycocoll and of lysin, as has been shown by OSBORNE and CLAPP.

3. The insufficient value of maize as food, and poisoning by zein, must be included among the chief causes of pellagra.

674 - **Anchylostomiasis among Peasants near Florence.** — PASSERINI, N., in *Atti della R. Accademia dei Georgofili*, Vol. XCIII, pp. 99-110. Florence, April 1915.

Anchylostomiasis is a disease which is widely spread in the Old and New Worlds. Its limits of latitude appear to be 50° 31′ N. and 30° S. The writer having recently observed that the gardeners and peasants of the plains near Florence had been largely attacked by this parasite, was led to examine if there was any connection between the disease and the nature of the soil, as it is believed that salt soils and those rich in lime are not favourable to the development of the larvae. He also investigated whether the spread of this worm could be attributed to the special conditions of the water used for drinking purposes or to the large use of faecal matter as manure. The paper includes observations on 50 patients ; of these 25 were peasants not concerned with market gardening ; 22 were market gardeners

or peasants who alternated market gardening with farming; two were farm hands and one a cottager. The disease thus attacks equally farmers and market gardeners. Of the fifty patients 23 were males and 27 females, that is in inverse proportion to previous observations; but this is due to the fact that hitherto statistics had dealt chiefly with data concerning miners and brickmakers. It remains to be seen whether the number of sufferers from this disease is greater among males or females. Age seems also to have some influence on the development of the disease, for among the fifty cases observed, thirty were between 11 and 30 years old. This is also due to the greater activity during that period of life.

All the patients live and work in a plain where the soil (of alluvial origin) contains variable quantities of carbonate of lime, but never high proportions. Of 29 samples of soil that were examined, 8 contained only traces of lime, 10 less than 1 per cent, and the remaining 11 quantities ranging between 1.3 and 9 per cent. None of these soils could be termed calcareous. In the neighbouring hills, where the soil is calcareous, no case of anchylostomiasis has so far been observed.

One condition favourable to the development of the larvae is the constant state of moisture in which they are kept, during the warm season, by continuous irrigation.

Accurate observations have proved that the drinking water could not be the cause of the spread of the disease among the fifty patients. Nor can the faecal matter applied to the vegetables as a fertilizer be a common cause of the spread of the worm, because no case was observed in the town where the produce of the gardens is consumed. Besides, in the sewage, the eggs and not the larvae of anchylostomes should be found. It is therefore probable that the spread of the worm is due to direct or indirect contact with the soil containing larvae. As prophylactic measures, the following are recommended: greater attention to personal hygiene, immediate treatment of the persons suffering from the disease, who are its carriers, and great care in not allowing the sick to reinfect the soil.

AGRICULTURAL EDUCATION

675 - **Agricultural Lectures for Wounded Soldiers at Petrograd.** — *Isvicstiia Glavnago Upravleniia Semleoustvoistva i Semliedieliia* (Intelligence of the General Direction of Land and Agricultural Organisation), No. 8, pp. 196-197. Petrograd, 1915.

The Imperial Museum of Petrograd has for some years past organised agricultural lectures for soldiers, which were given by the Museum staff. The course was interrupted at the beginning of the war, but was resumed when the military hospitals were filled with soldiers who had been wounded on the battlefield. These lectures are not considered as an amusement for the soldiers, but as forming part of the agricultural propaganda among the rural population, and the wounded much appreciate them.

All the lectures are illustrated by means of special lantern slides and the demonstration specimens of the Museum; the audience are presented with books, pamphlets, wall-maps, etc., dealing with agricultural matters. Those wounded whose state of health allows them to leave the hospital visit the Museum very readily; the staff gives them all necessary information, while once a week, in the afternoon, cinematograph pictures of agri-

cultural subjects are shown and explained. In order to fix the subjects of the lectures better in the minds of the hearers, the Museum publishes short illustrated summaries of each, with a list of the books dealing with it.

At the present time, agricultural lectures are being held in 83 hospitals in Petrograd and the neighbourhood.

676 - **Special Demonstration Cars for Travelling Courses of Bee-keeping, Gardening and Market Gardening in Russia.** — *Khosiaistvo* (The Farm), No. 10, p. 279. Kieff, 1915.

The last ten years of Russian rural life have been distinguished by the powerful and rapid development of several organisations founded for the purpose of promoting agricultural progress. The Minister of Railways has just organised free courses of bee-keeping, gardening, and market gardening on all the railway lines of Russia-in-Europe and Russia-in-Asia. Special cars have been arranged in which to hold lectures, and these will circulate on all lines. The demonstration cars are provided with wall-maps, pictures and other teaching material necessary to the lecturers. Gardens, market gardens and apiaries will be established near stations for purposes of demonstration. These demonstration cars are already working with excellent results on the Tashkend railways.

CROPS AND CULTIVATION.

677 - **The Influence of Weather Conditions upon the Amounts of Nitric Acid and of Nitrous Acid in the Rainfall in Victoria, Australia.** — ANDERSON, V. G. (Research Scholar, Melbourne University) in *Quarterly Journal of the Royal Meteorological Society*, Vol. XLI, No. 174, pp. 99-122, 11 figs. London, April 1915.

AGRICULTURAL METEOROLOGY

Previous investigations of the amounts of oxidised nitrogen in rain-water have been carried out almost entirely from the standpoint of the agricultural chemist and principally with a view to finding the monthly and yearly amounts of combined nitrogen per acre carried by rain to growing crops and pasture lands. The present researches were designed to reveal any relations which might exist between the amounts of nitric and nitrous acids in the rainfall on the one hand and the meteorological conditions of the atmosphere on the other. It was also hoped to determine the conditions under which oxy-compounds of nitrogen are formed in the air and to study the effect of city air upon the amounts of nitrogen acids in the rain.

The experiments covered a period from August 1912 to March 1914 and involved the determination, each day, of the amounts of nitric acid and of nitrous acid in samples of rain-water collected at the centre of Melbourne and at the suburb of Canterbury, six miles distant.

The nitric nitrogen was determined by the salicylic method of CARON and RAQUET and the nitrous nitrogen by a slightly modified form of the method of GRIESS using sulphanilic acid and a-naphthylamine.

With regard to the ratio $\frac{\text{nitric nitrogen}}{\text{nitrous nitrogen}}$ it is remarkable that in no case during the period under review was the ratio less than 1 : 1. In winter

only, the value of the ratio approached unity, whilst in summer it reached a maximum of 140. The similarity between the temperature curve and the curve of variation of the ratio supports the assumption that the ratio is a function of the temperature. It seems probable that the variations in the ratio are due to changes in the velocity of transformation of nitrous to nitric acid due to variations of temperature. The origin of the nitric and nitrous nitrogen in rain would appear to be atmospheric nitrogen peroxide, so that if the rain-water could be analysed immediately, before any change had occurred, the nitric and nitrous acids would be found in equal molecular proportions.

The analyses showed that for any one type of weather the concentration of the oxidised nitrogen varies inversely as the rainfall and that the total amount is independent of the rainfall. This shows that the first fall of rain removes almost all the nitrogen peroxide from the air, so that subsequent rain is almost free from the nitrogen acids. The concentration of nitrogen peroxide in the air should reach a definite and constant value (before rain has fallen) for each type of weather, *e. g.* the concentration during a tropical storm should be relatively great and during antarctic storms extremely small.

Investigations of nine well-defined recurring types of rainstorm showed that the amounts of oxidised nitrogen per day varied from 1.5 lbs. per 1 000 acres in the case of certain antarctic storms to 35.0 in the case of intense tropical storms.

Thus, by devising methods for measuring extremely small amounts of nitrogen peroxide in the air it should be possible to trace the movements of air-currents flowing either from the tropics or from the antarctic belt and to identify each of them with certainty by means of the nitrogen peroxide contained in them.

In discussing the above paper, Dr RUSSELL remarked that the variation in nitrogen content of rain in England is very slight and insufficient to form a basis for sorting out weather types. This method is probably only applicable to continental countries where the variation is greater.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

678 – **Soil Ventilation.** — HOWARD, A., and HOWARD, G. L. C. — *Agricultural Research Institute, Pusa, Bulletin* No. 52, 35 pp. Calcutta, 1915.

The alluvial soils of the Indo-Gangetic plain in India are characterised by a fine even texture and by the faculty which their constituent particles possess of running together to form a hard crust or cement after heavy rains or irrigation. This latter property, combined with the fact that in many parts, when the monsoon is at its height, the water-table may rise to within a few feet of the surface, makes the proper ventilation of the soil a somewhat difficult matter. A considerable amount of evidence is brought forward to show that the crops in these regions frequently suffer from asphyxiation. Such crops exhibit various signs of loss of vigour which are usually interpreted by the native cultivators as an indication that more irrigation water is required, with the result that the condition of the crop is merely aggravated by continued waterings. On the other hand, experiments have now proved that immediate benefit is derived when measures

are taken to break up the crust and aerate the soil to as great a depth as possible.

In other parts of India, as for instance the Quetta Valley, where similar kinds of soils are found under totally different climatic conditions, soil aeration has also been shown to be deficient, though in this case there can be no lack of drainage and the harmful effects must be attributed solely to the impermeable crust formed on the surface of the land.

The necessity for aeration is still more marked where green manuring is practised and a great similarity may be noted between the harmful effects produced by ploughing in green vegetable matter and those observed when fruit trees are planted in grass land. It is therefore suggested that there exists a connection between the two phenomena, *i. e.* the excessive production of carbon dioxide, which becomes deleterious when it forms too large a proportion of the soil atmosphere.

Over and above having discovered the cause of much damage to crops, the writers, in showing the part played by soil aeration on all irrigated lands, have indicated a means of economising water and thus extending the benefits of irrigation over a larger area of the country than was thought possible.

679 – **Researches on the Concentration of the Liquid Circulating in the Soils of Libya.** – PANTANELLI, E., in *Bullettino dell'Orto Botanico della R. Università di Napoli*, Vol. IV, pp. 371-383. Naples, 1914.

The writer applies the new osmotic theories of the soil to the study of the cultivated and sub-desert soils of Libya, in comparison with the cultivated and uncultivated soils of the district of Naples. He determined: the electrolytical conductivity according to KÖNIG and his collaborators (1) of the "pedolytic liquid", that is to say the aqueous extract obtained by percolation according to GOLA'S method (2); the total dry residuum; the dry residuum after dialysis; and, by difference, the crystalloids present in the said liquid. The accompanying table shows the results:

Average electrolytical conductivity of the pedolytic liquid.

Soils	K × 10⁴
Oasis (sand)	6.21
Gardens	4.91
Steppes of the plains	5.59
"Dafnia" (intermediate steppes on limestone shelf)	10.89
Hill steppes	7.87
Cultivated hill soil	11.48
Dunes	1.78
"Sebkas" (salt land)	205.85

The best cultivated soils (sands of the oases and gardens) furnish a liquid of low concentration and almost similar to that of Italian soils; the

(1) See. *B.* Jan. 1911, No. 51. (*Ed.*)
(2) See *B.* Dec. 1912, No. 1606. (*Ed.*)

steppe solution, both in the plains and in the hills, is also weak; the solution of the " dafnia " soil, as well as that of the cultivated hilly ground, is more concentrated ; the dunes supply a very dilute solution, while that of the " sebkas " is saline and in some parts very concentrated. Uncultivated land in the neighbourhood of Naples shows a minimum concentration at a great depth, which increases with manuring and the bacterial activity developed by plant growth. In the sands of the oases, the steppes and the dunes, the concentration of the soil solution increases slightly with the depth, while the contrary holds in the case of the " sebkas ".

The sandy soils and sands of Tripolitania often give up to pure water large quantities of colloids, a fact which proves that they weather and disintegrate easily, and shows that they might be transformed by irrigation into very good agricultural soil. The richer the liquid that moistens the soil is in salts, the poorer it is in colloids ; this is probably due to the complete flocculation of the latter by the action of the salts. The determination of the total dry residue of the pedolytic liquid (Gola's method) is, however, not always sufficient to allow of an opinion being formed as to the concentration of the liquid itself. This occurs, for instance, in the case of very fine sands such as those of Tripolitania, which when acted upon by water, easily part with particles that remain more or less in suspension. Nevertheless, in other cases there is nearly always an approximate relationship between the richness of the extract and the osmotic concentration of the pedolytic liquid, so that Gola's data can still be used for the deductions which he has drawn from them.

680 – **The Storage and Use of Soil Moisture.** — Burr, W. W. — I. *Agricultural Experiment Station of Nebraska, Research Bulletin* No. 5, 88 pp., 2 figs, 15 diagrams. — II. *Id. Research Bulletin* No. 140, 20 pp. Lincoln, Nebraska, 1914.

These bulletins report experiments carried out during 1907 to 1912 at the Experimental Sub-Station of Nebraska at North Platte, in collaboration with the Bureau of Dry-Farming and the Bio-physical Laboratory of the Bureau of Plant Industry of the United States Department of Agriculture.

The object of the experiments was the study of the problems concerning the accumulation and use of soil water. The soil used was a silty sand, or loess, and the subsoil conditions such that the crops depend absolutely on the rainfall, which averaged 18.6 inches (472 mm.) during 1875-1912 ; June has the highest monthly average and January the lowest. These facts should not be lost sight of in considering the following results.

The maximum quantity of water retained by this soil under cultivation varies between 16 and 18 per cent of its dry weight ; the minimum content at which crops can still obtain water is about 7 or 8 per cent ; in other words the soil water above 7 or 8 per cent of its dry weight is available for plants. Summer follow is the most effective means of accumulating water in the soil and the relative quantity of this depends upon a number of factors, *viz.* the nature and distribution of the rainfall, the efficiency of the cultivation and the presence or absence of a crop. At the North Platte Sub-Station, in a period of six years the soil accumulated from 6 to 33 per cent

of the rainfall each season and in favourable years the soil was practically saturated to a depth of 6 or 7 feet. With regard to the storage of water in the soil, the distribution of the rainfall is just as important as the quantity; water accumulates more rapidly when the rains are sufficiently frequent to maintain the surface of the soil damp during the intervals. One inch of rain falling on a very dry surface rarely moistens more than 6 inches, whilst a fall of half an inch is only stored if the soil is already damp from previous rain. Water passes more rapidly through a damp than through a dry soil. A cultivated soil retains water better than an uncultivated soil ; and this difference is greater in proportion as the rainfall is heavier. Ploughing is more efficient than disc harrowing in accumulating water in the soil ; disc harrowing is more successful on a stubble in destroying weeds and in stirring the surface soil, but a mulch of several inches of hay or straw is still more efficacious in storing water.

Maize, oats, spring wheat and barley use the soil water to a depth of 4 or 5 feet ; winter wheat uses water to a depth of 6 or 7 feet ; maize sown in rows and hoed uses less water than other cereals.

Plants appear to extract the water from the soil by developing their roots in the moist soil ; capillary movement appears to play only a small part. Under normally favourable conditions vegetation in an active state of growth is a more important factor than surface evaporation in removing the water from previously saturated soil. Weeds are often the most active agents in consuming the soil water and in preventing its storage in the soil for the benefit of other plants. A 3-inch straw mulch is the best means of diminishing surface evaporation during prolonged drought. In these particular soils lucerne when once established utilises the water to a depth of 20 to 30 feet.

Capillarity is a useful means of supplying the water requirements of plants within certain limits when water is available ; for instance, it may be an important factor when the water-table is just at the lowest limit reached by the roots of the crop. But the water-table may be too low for capillarity to supply the roots, as in the case of the high lands of Nebraska.

According to these researches, the production of 1 lb. of dry matter of wheat, rye, oats and barley requires twice as much water in an unfavourable as in a favourable season. Unfavourable conditions to these cereals do not necessarily constitute an unfavourable season for maize, as its chief growing-period is so much later.

681 – **The Humidity of Loam Soil under Different Crops.** — Von Seelhorst, C. (Agr. Expt. Station of the University of Göttingen), in *Journal für Landwirtschaft*, Vol. XLIII, Part I, pp. 51-72, 3 figs. Berlin, 1915.

This paper contains the results of 13 years' experiments on loam soil carried out in the agricultural experiment field of the University of Göttingen (cf. *Journal für Landwirtschaft*, 1902 and 1906). They are based on the data given in the accompanying tables.

TABLE I. — *Crops (averages* 1901-1913), *lbs. per acre.*

Rye		Wheat		Oats		Potatoes	Beets	Peas (Victoria)	
grain	straw	grain	straw	grain	straw			seed	haulm
3 031	6 740	3 353	6 283	2 673	5 090	19 708	90 200	1 417	3 080

TABLE II. — *Rainfall (averages* 1901-1913), *mm.*

Year	April	May	June	July	August	September	October	November
656.7	44.0	58.1	70.9	74.8	69.6	58.2	44.1	53.2

TABLE III. — *Humidity of Soil at Different Depths (averages* 1901-1913), *per cent of dry soil.*

Crops	Depth, inches	April	May	June	July	August	Sept-ember	October	Nov-ember
	10	22.2	21.4	20.2	17.6	18.4	19.9	20.5	22.0
Potatoes	20	22.3	21.9	21.2	19.5	18.5	20.1	20.4	21.2
	30	22.6	22.2	21.8	21.0	19.6	20.8	20.8	21.6
	10	21.0	17.8	16.3	16.8	19.0	20.5	20.5	22.6
Rye	20	21.8	19.9	17.2	16.8	17.3	19.7	20.2	21.5
	30	22.1	21.4	19.0	19.0	18.7	20.0	20.3	21.4
	10	22.3	21.1	20.2	16.5	16.8	19.0	20.0	22.1
Beets	20	22.3	21.9	21.4	18.8	16.9	18.2	19.5	21.4
	30	22.6	22.2	21.8	20.0	18.7	17.8	19.4	22.0
	10	22.2	20.5	17.1	16.7	19.3	20.7	20.7	22.1
Peas	20	22.0	21.2	19.0	15.9	17.5	19.8	19.8	21.4
	30	22.5	22.2	21.0	18.5	18.6	19.5	20.4	22.0
	10	22.3	20.1	16.1	16.3	18.5	20.0	20.4	21.4
Oats	20	22.2	21.5	17.4	15.7	15.7	17.0	19.6	21.3
	30	22.5	22.0	19.6	16.7	16.7	17.7	19.1	21.2
	10	21.9	18.8	16.0	14.8	17.9	20.1	20.2	22.2
Wheat	20	22.1	20.5	16.5	14.8	14.8	18.6	20.0	21.3
	30	22.3	21.5	19.3	16.9	16.3	18.2	19.7	21.2

In the first place, it is seen that soil under *potatoes* is almost always the dampest, *i. e.* this crop uses the smallest amount of water ; soil under *rye* is the driest in April and May, on account of the cereal's rapid growth during those months. As regards *beets*, from April to June the soil is about as moist as in the case of potatoes ; on the other hand, the consumption of water by the former increases from July onwards and is greater than that by potatoes. *Peas* use relatively little water and thus take the third place after potatoes and rye ; their water consumption begins in May and becomes large in June. *Oats* commence to utilise the water of the upper soil layers in May and continue to do so during June ; their development is strongest in July and they then draw upon the water of the lower layers, which by August is also exhausted. As regards *wheat*, its need of water is apparent in May and thus it comes next to rye ; its water consumption increases in June, and in July land under wheat is the driest of all, except that at a depth of 30 in. it is a little damper than land under oats. In the case of both these cereals the dry conditions are maintained even into August.

For these reasons, potatoes, rye and peas are the most suitable plants for relatively light soils, owing to the small amount of water they require and the fact that they only draw upon the water of the upper layers. On the other hand, wheat, beets and oats are better suited to relatively heavy soils, as they use more water and draw upon the deeper layers.

682 – **The Influence exerted by the Nature of the Soil upon the Bacterial Life and Chemical Changes in the Soil.** — CHRISTENSEN, H. R. (Danish Crop Experiment Organisation) : I. Studier over Jordbundsbeskaffenhedens Indflydelse paa Bakterielifvet og Stofomsaetningen i Jordbunden. — *Tidskrift for Planteavl*, Vol. 21, Part 3, pp. 321-512, 21 figs. Copenhagen, 1914. — II. Studien über den Einfluss der Bodenbeschaffenheit auf des Bakterienleben und den Stoffumsatz im Erdboden. — *Centralblatt für Bakteriologie etc., II. Abt.*, Vol. 43, No. 1-7, pp. 1-166, 21 figs., 2 plates. Jena, 1915.

In these, as in his previous researches (*Tidskrift for Planteavl*, XIII, pp. 167-171, 1906), the writer used Remy's method of cultures in inoculated solutions of mannite. In his present experiments he used numerous soils for inoculation and first showed that *Azotobacter* is not always found in soils containing a sufficiency of basic substances, especially of lime ; but that its presence and its diffusion depend mainly on the reaction of the soil and particularly on its basic character. Thus this bacterium is very common in alkaline soils, that is to say, in those containing sufficient calcium carbonate to give effervescence with hydrochloric acid ; it is rarely found in neutral soils and scarcely ever in acid ones. Consequently, its disappearance from a soil does not depend so much upon the presence of substances having a toxic action upon bacteria, as upon the absence of basic compounds necessary to its life, especially the carbonates of lime and magnesia. The behaviour of this micro-organism towards phosphoric acid does not appear to be so precise ; in any case, the fact that a large development of *Azotobacter* was obtained in a mannite solution without phosphates would seem to show that the inoculated soil was not deficient in phosphoric acid.

The microbes which produce fermentation in mannite are to be found in

all arable soils, their numbers depending upon the amount of lime present in the required form. With regard to the power of decomposing peptone possessed by a soil, great differences exist according to the various cultivated soils ; these depend partly upon the chemical composition of the latter, phosphoric acid being important, and partly on their biological conditions. As a rule, the addition of carbonate of lime is of no effect and none of the soils were affected in this direction by the addition of humus. Usually a weak power of decomposing peptone seems to indicate conditions unfavourable to plant growth.

The rapidity with which cellulose was decomposed seemed on the other hand to depend upon their chemical composition, since inoculation had no effect ; lime and phosphoric acid would appear to be the principal factors concerned. As had been previously shown, the addition of moor peat gave no formation of nitrites in the solutions used ; this seems to depend more upon the absence of nitrite-producing organisms than upon the presence of inhibiting bodies.

To sum up, the main idea resulting from all these researches is that bacterial life, and the transformations of the soil substances connected with it, depend essentially upon the reaction and the basicity of the soil, as well as upon the presence of soluble phosphoric acid.

The article concludes with a bibliography of 93 works.

683 - **Antagonism between Anions as Affecting Soil Bacteria.** (1). — LIPMAN, C. B., and BURGESS, P. S. (California Agricultural Experiment Station) in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 42, No. 17-18, pp. 502-509. Jena, November 1914.

This paper is one of a series of five papers (2) dealing with the toxicity of the common alkali salts NaCl, Na_2SO_4 and Na_2CO_3 towards the more important groups of soil organisms, namely the ammonifying, nitrifying and nitrogen-fixing flora, in their natural condition. It concerns the relation of salt combinations to the natural nitrogen-fixing flora of the Anaheim sandy soil. The method employed was as follows : 50 gm. portions of the soil were distributed in tumblers and one gram of mannite and the necessary sterile distilled water added along with the salts which were to be studied. The moistened soil was then thoroughly stirred and the tumblers were covered with Petri dish covers and incubated for 4 weeks at 28° to 30° C. After incubation the soils were dried and ground and 20 gram portions were taken for analysis by the modified Gunning method.

Some evidence of antagonism was obtained in the case of combinations of sodium carbonate and sodium chloride and of sodium chloride and sodium sulphate, but none could be found in the case of sodium sulphate and sodium carbonate.

The concentrations at which nitrogen fixation ceases are lower when the salts are mixed than when they are used singly.

(1) See also *B.* Feb. 1915, No. 143. (*Ed.*)

(2) See *Centralblatt für Bakt.*, Abt. II., Bd. 32, p. 58 ; Bd. 33, p. 305 ; Bd. 35, p. 647 ; Bd. 36, p. 383.

While marked antagonism between anions was found in the case of nitrification, it is only very feeble or absent in the case of the nitrogen-fixing flora. The ammonifying flora occupies an intermediate position. Thus antagonism between ions is only of practical significance in the cases of the ammonifying and nitrifying floras and of no significance for the nitrogen-fixing flora.

684 - **Methods of Counting Bacteria.** — BREED, R. S., in *Science*, Vol. XLI, No. 1061, p. 660. Lancaster, Pa., April 30, 1915.

The writer criticises the methods of counting bacteria, *viz*: the microscopic, the dilution and the plating methods. During recent years the last method has been most frequently adopted. The few comparative tests that have been made of this method show that there are uncontrollable elements in the technique which cause large errors. In both the dilution and the plating methods errors are liable to be introduced by the uncertainty of growth in the culture medium used and also in the possible clumping of the organisms. The microscopic method is free from these sources of error, but does not distinguish between live and dead organisms, thus causing the count to be larger than it should be. The so-called bacterial "counts" are therefore much better styled "estimates".

685 - **Irrigation of Farm and Garden Crops in the United States.** — I. WELCH, J. S.: Irrigation Practice. – *Idaho Agricultural Experiment Station, Bulletin* No. 78, pp. 4-27. Moscow, Idaho, January 1914. — II. KNORR, FRITZ (Superintendent Scotsbluff Experiment Substation, Mitchell, Nebraska): Irrigated Field Crops in Western Nebraska. – *Agricultural Experiment Station of Nebraska, Bulletin* No. 141, Vol. XXVI, No. III, pp. 5-31. Lincoln, Nebraska, May 1914. — III. WELCH, J. S.: Potato Culture under Irrigation. – *Idaho Agricultural Experiment Station, Bulletin* No. 79, pp. 17-27. Moscow, Idaho, April 1914. — IV. KNORR, FRITZ: Vegetable Gardens on Irrigated Farms in Western Nebraska. – *Agricultural Experiment Station of Nebraska, Bulletin* No. 142, pp. 5-24. Lincoln, Nebraska, April 27, 1914.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

I. — The object of these investigations is: 1) to obtain accurate information regarding the amount of water to be applied to common crops; 2) to determine the critical periods in the development of the plants when irrigation is most required and most effective; 3) to determine the best method of applying the water. In every case careful measurements were made of the water applied to each plant and of the waste water, so that the amounts reported represent the water actually absorbed by the plot. The area of the plots for each crop was about 4 acres.

Alfalfa: About 2.75 acre-feet of water applied in 7 or 8 applications in the first season is found to be most profitable. During the first year the corrugation method of irrigation is much superior to free flooding, but this difference is not apparent during later seasons except on light soils.

Wheat: The best results can be obtained with less than 1 foot per acre of water applied in one or two applications, the first one not before the "booting" stage (*i.e.* just before the emergence of the ear). The various stages of development are: jointing, booting, heading, flowering, soft dough (or cheesy), hard dough and maturity. The difference in the time of irrigation caused no variation in the dates of heading. Irrigation at the

jointing stage gives the greatest height of plant but does not prevent the subsequent shrivelling of the grain, and though a greater yield is obtained by irrigation at this stage than at later stages it is more profitable to give a single irrigation at the heading stage, owing to the better quality of the grain produced. Irrigation at the hard dough stage is of no value, the best results being obtained from application at the jointing, booting and soft dough periods. The most satisfactory method of irrigating wheat appears to be flooding between borders.

In the case of spring wheat the total amount of water should be increased to 1 or 1 ½ feet per acre.

Oats: This crop requires much the same treatment as wheat, though it is less liable to injury from excess of water.

Barley: Though the interval between the successive stages of barley are shorter than in the case of wheat the same methods of irrigation apply to both.

Potatoes: The best time to apply the water is when the tubers begin to form and once irrigation is started it should be continued throughout the season. The ground should never be flooded and the furrows should be so deep as to prevent the water coming into direct contact with the tubers. The greatest yield and highest percentage of marketable potatoes was obtained with about 1 ¾ feet of water given in four applications.

The efficiency of the water used in irrigating sage-brush land was considerably increased by application of farmyard manure, growing leguminous crops and the use of a proper system of rotation.

II. — Similar methods to the above are recommended for cereals and alfalfa. In the case of beets continuous applications are required from the time of thinning until about 3 weeks before harvesting. Potatoes rather than beets should follow alfalfa in the rotation. Emphasis is placed on the necessity of deep irrigation for potatoes and unless wilting occurs the first application should be made about the time of flowering. The irrigation should be followed by cultivation of the surface soil.

In the case of maize, irrigation should not be given until the flowering stage. The least possible amount of water for continuous growth gives the best results.

III. — This writer recommends the irrigation of potatoes about the time the tubers begin to form, followed by 4 applications making a total of 1 ¾ feet of water. The importance of deep furrows is also pointed out.

IV. — This article deals with the irrigation of garden crops. In preparing the ground a slope of 3 inches per 100 feet is most suitable. Perennial vegetables should be confined to one portion of the garden so as not to interfere with the annual cultivations. Excess of water is more to be avoided than too little. Fruiting vegetables, such as tomatoes, cucumbers and cantaloups, should not be irrigated until the fruit sets and only in limited amounts.

686 - **A Comparison of Tillage and Sod Mulch in an Apple Orchard** (1). — HEDRICK, U. P., in *New York Agricultural Experiment Station, Bulletin* No. 383, pp. 249-281, 6 plates. Geneva, N. Y., 1914.

A continuation of the studies at the New York Agricultural Experiment Station to determine whether the apple thrives better under tillage or in sod. The experiment summarised in this paper was begun in 1903 in an orchard of Baldwin trees. The tilled land was plowed each spring and cultivated from four to seven times. The grass in the sod plot was usually cut once, sometimes twice, all other operations being identical for all the plots.

The experiment was divided into two 5-year periods. During the first period the orchard was divided in halves by a north and south line, and during the second period by an east and west line. Thus, one quarter of the orchard was under tillage 10 years; another under tillage 5 years, then left in sod 5 years; the third quarter was in sod 10 years and the fourth in sod 5 years, then tilled 5 years.

The writer summarises the results as follows:

The average yield of the plot left in sod for ten years was 69.16 barrels per acre, that of the plot tilled 10 years 116.8 barrels per acre, making a difference in favour of tillage of 47.64 barrels per acre per annum. The fruit from the sod plots was more highly coloured than that from the tilled land and matured from one to three weeks earlier than the tilled fruit. The latter keeps from two to four weeks longer than the former and is also better in quality, being crisper, juicier and of better flavour. The uniformity of the trees under tillage was in striking contrast to that of the trees in sod, which lacked uniformity in every organ and function of which note could be taken. The grass had also a decided effect on the wood of the trees, as evidenced by the greater number of dead branches and the less plump and duller appearance of the sodded trees. The leaves of the tilled trees came out three or four days earlier and remained on the trees several days longer than on the sodded trees. Those on the tilled trees were a darker, richer green and more numerous, indicating greater vigour.

The effects of the change from sod to tillage were almost instantaneous. Both tree and foliage were favourably affected before midsummer of the first year, and the crop, while below normal, consisted of apples as large in size as any in the orchard, the falling-off in yield being due to poor setting. The change from tillage to sod was quite as remarkable and as immediate, the average yield of the new sod plots being less than half that of the tilled plots. The use of nitrate of soda in the sod plots greatly increased the vigour of the trees and was a paying investment, yet for the 5-year period the yield was only slightly more than half as much as that of the tilled trees.

The very marked beneficial effect on sodded trees of placing adjacent ground under tillage shows that the sod should not only be removed round the trees but also for a considerable distance from them.

(1) See also *B.* Feb. 1915, No. 145. (*Ed.*).

The changes in the soil due to the two systems concern chiefly the amount of humus and nitrogen. It was found that tillage and cover crops conserve humus and nitrogen better than the sod-mulch treatment.

The pasturing of pigs, sheep or cattle on sodded orchards does not overcome the bad effects of the grass.

The average cost per acre of growing and harvesting apples in sod was $ 57.73 and under tillage $ 83.48, making a difference of $ 31.75. Subtracting these figures from the gross return, leaves a balance of $ 74.31 for the sodded plots and $ 140.67 for the tilled plots, or an increase of $ 66.36 in favour of tillage.

MANURES AND MANURING

687 - **The Influence exerted by Organic Substances upon the Decomposition and Action of Nitrogenous Compounds in the Soil.** — GERLACH, in *Mitteilungen des Kaiser Wilhelms Instituts für Landwirtschaft in Bromberg*, Vol. VI, Part 5, pp. 309-327. Berlin, 1915.

Previous pot experiments made by the writer and DENSCH (*Mitteilungen des Kaiser Wilhelms Instituts für Landwirstschaft*, IV) have shown that sugar and straw when dug in, either alone or with the addition of nitrate of soda and sulphate of ammonia, have an unfavourable effect upon crops, even after only 2 ½ months ; later their action becomes favourable. The experiments further showed that nitric and ammoniacal nitrogen, in the presence of organic substances, are first changed into insoluble albuminoid nitrogen ; later the albuminoid compounds are decomposed and the nitrogen becomes available to plants. Thus in the second and third years an increase in the crop is observed. Nevertheless, even in three years, the utilisation of the nitrogen in nitrate of soda and sulphate of ammonia was less in the presence of straw and sugar than when they were applied alone, without it being possible to observe any nitrogen fixation or denitrification due to soil bacteria.

The present experiments were carried out in open ground and in walled plots 1 metre square ; the treatment was as follows :

General manuring : Each plot received 10 gms. of potash in the form of kainit and 8 gms. of citric-soluble phosphoric acid in the form of basic slag.

Plots: Six series of 5 plots with the following manures per plot : I, unmanured ; II, 30 gms. of nitric nitrogen in the autumn of 1909 and 20 gms. in the autumn of 1910 ; III, 2 000 gms. chopped straw in autumn of 1909 ; IV, 500 gms. chopped straw in autumn of 1909 ; V, 30 gms. nitric nitrogen and 2 000 gms. chopped straw in autumn of 1909 ; VI, 30 gms. nitric nitrogen in spring of 1910, 5 gms. in autumn of 1910, 15 gms. in spring of 1911, 40 gms. nitrate of lime in spring of 1912, 20 gms. in spring of 1913.

Crops : 1910, oats ; 1911, rye ; 1912, carrots ; 1913, barley followed by mustard.

The total production of the 5 plots of Series I throughout the experiments was 9076.47 gms. of dry matter, with 85.51 gms. of nitrogen ; the 5 plots of Series II produced 9 397.92 gms. of dry matter, with 85.20 gms. of nitrogen ; that is to say, an excess of only 3.54 per cent, and less nitrogen ; thus nitric nitrogen has hardly any effect and suffers loss during the winter.

As to the effect of the straw, Series III gave 9240.86 gms. of dry matter, with 85.78 gms. of nitrogen, while Series IV gave 9109.26 gms. of dry matter with 86.66 gms. of nitrogen, or an excess over Series I of 1.81 and 0.36 per cent of dry matter, and 0.32 and 1.34 per cent of nitrogen respectively. This shows very weak action on the part of the straw and the nitrogen it contains, and consequently is not an argument in favour of the suggestion that had been made of using straw or other organic substances to increase the fertility of the soil. The same appears also from the results obtained in Series V, which gave a total production of 9 896.05 gms. of dry substance, with 91.98 gms. of nitrogen, the difference between this and Series III being 7.09 and 7.2 per cent; this is equivalent to saying that only 20.7 per cent of the nitric nitrogen applied with the straw went into the crop. In Series VI, on the other hand, 15 726.49 gms. of dry substance were obtained with 157.99 gms. of nitrogen, an excess over Series I of 73.25 per cent and 77.51 per cent respectively; thus 60.02 per cent of the nitric nitrogen given found its way into the crop.

Practical experiments under ordinary cultural conditions are also in progress; but in any case, the use of straw cannot at present be recommended as a means of increasing soil fertility and promoting the utilisation of nitrogen.

688 – **Kelps of the Pacific Coast: their Composition and Availability as Manures.** — I. HOAGLAND, D. R., and II. STEWART, G. R. (Assistant Chemist, Agr. Expt. Station of the University of California), in *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 39-57 and 21-38. Washington, D. C., April 1915.

I. — Investigations of the Pacific Coast kelps were made with *Egregia* spp., *Laminaria andersonii*, *Iridaea* spp., *Nereocystis luetkeana*, *Macrocystis pyrifera* and *Pelagophycus porra*, and concerned the general study of the important chemical groups (salts, nitrogen, ether-extract, crude fibre, pentosans, water-soluble alcohol precipitate, etc.), the forms of nitrogen, carbohydrates, cellulose, hydrolysis, sulphur content, forms of iodine, and economic application (including distillation products).

An extensive series of analyses is given concerning the nature of the carbohydrate bodies and the nature of algin. A high content of organic sulphur and small percentage of organic iodine is noted. With regard to feeding value and utilisation of by-products, the results indicate only slight possibilities in these directions.

II. — Investigations were carried out to determine the form in which kelps can be most economically and completely utilised. In addition to studies of the availability of the organic matter, potash and phosphoric acid, the effect of the salts on the biological activities of the soil was also determined. The three kelps studied were *Macrocystis pyrifera*, *Nereocystis luetkeana* and *Pelagophycus porra*. Bacteriological studies were made with samples of fresh field soils, excluding the surface soil to a depth of 1 ½ to 2 inches.

In the first series the ammonification and nitrification of the kelps was compared with that of dried blood and cottonseed meal. The proportion of dried and ground kelp was 10 gms. to each 200 gms. of soil; duplicate

cultures were made with 1 gm. of dried blood and 2 gms. of cottonseed meal, while blank determinations of untreated soil were started to determine the ammonia and nitrate production occurring in the natural soil. The first ammonia determinations were made at the end of 9 days of incubation, later determinations being made at periods of 11, 15, 19, 48 and 102 days. Even at the end of 9 days very striking differences were found. Next in rate of ammonification to the dried blood was cottonseed meal, followed closely by *Nereocystis* and *Pelagophycus*, while *Macrocystis* was only slightly converted. This relationship with regard to ammonification is maintained throughout the whole series. Nitrification was almost entirely inhibited with all the kelps.

Since *Macrocystis* is the only kelp of commercial importance in California, it was studied in more detail, using fresh material in different quantities and testing it with different soils. The sun-dried kelp contains 10.52 per cent of moisture and 30.8 per cent of soluble salts, whereas the fresh material contains 87.9 per cent moisture and 4.6 per cent soluble salts. It was found that fresh *Macrocystis*, whether leached or unleached, is readily decomposed by all the four soils used. The leaching, which removes a considerable portion of the soluble salts present, did not increase the rate of ammonification. Nitrification occurred with the fresh kelp in all the soils except a sandy type. The difference in the rate of decomposition between fresh and dried kelp is much greater than that of other green manures.

Experiments were then made with smaller quantities of dry *Macrocystis* and *Nereocystis* alone and in combination with dried blood. The quantities of kelp added supplied 10, 50 and 100 mgms. of nitrogen respectively, and the dried blood supplied 10 and 100 mgms. of nitrogen. These sets were compared with dried blood alone and with untreated soil. The periods of incubation were 2, 4, 11 and 15 weeks. The sets with 10 mgms. of added nitrogen from kelp gave too small amounts of ammonia to be any use. The addition of 50 mgms. of nitrogen from *Macrocystis* caused a gain of ammonia in 4 weeks and a great reduction in the quantity of nitrates present. At 11 weeks there is not only an appreciable gain of ammonia, but the nitrate production is almost normal. After 15 weeks the ammonia present is the same as in the blank and 6 per cent of nitrogen has been gained in nitrates. The results with 100 mgms. of nitrogen from *Macrocystis* were similar. This kelp was sun-dried and contained more moisture than the material used in the first series.

The addition of *Macrocystis* to dried blood reduced the total yield of nitrogen at 4 weeks. At 15 weeks the inhibitory effect of the kelp ceased and the yield of nitrogen increased. In the case of *Nereocystis* there is a steady and uniform production of ammonia and nitrates, except with the larger quantities.

The decomposition of *Macrocystis* was then studied in the fresh, air-dry, highly heated, and partially dry conditions, with a view to determining the degrees of availability between the various forms of kelp. It was found that partially dried kelp containing 28 per cent of moisture was more readily decomposed than the fresh sample, and that the air-dry and

heated kelp gave no result. Samples of kelp containing 28 to 37 per cent of moisture can be stored without danger of decay or mold.

It is also concluded that the manurial value of kelp is not improved by leaching and that neither the kelp nor the salts contained in it would have any effect on either ammonification or nitrification in actual practice.

689 – ***Tephrosia vogelli* as a Green Manure and as a Windbreak in Java.** — ARENS, P., in *Mededeelingen van het Proefstation Malang*, No. 7, pp. 25-28. Soerabaia, December 1914.

According to inquiries made on certain plantations, *Tephrosia* has considerable value as a windbreak and green manure. Unfortunately it is badly attacked by an eelworm (*Heterodera*). Though this has no importance in the case of coffee, which is resistant to eelworm, in the case of tea, cinchona and tobacco the greatest precautions are necessary in its use on plantations.

690 – **Wood Waste from Saw-Mills as a Source of Potash.** — GIMINGHAM, C. T. (University of Bristol, Agricultural Research Station) in *The Journal of the Board of Agriculture*, Vol. XXII, No. 2, pp. 146-148. London, May 1915.

In addition to the potash from hedge clippings and vegetable refuse, etc., the writer draws attention to the value of wood scraps, saw-dust and shavings, produced in enormous quantities in saw mills. In localities where this wood waste is not saleable for other purposes it may with advantage be converted into ash and used as a potash manure. The flue dust from gas-producing plants may contain as much as 10 per cent of potash, thus possessing the same value as kainit.

Other analyses of the ash gave the following figures :

	K_2O per cent
1. Coarse ash, combustion very complete	7.24
2. » » » » »	5.08
3. Flue dust » » »	9.11
4. » » » » »	6.35
5. » » coarser than 3 and 4	5.89
Average	6.73

On the basis of the ordinary price of kainit, ashes with the above composition should be worth from 25 to 50 *s.* per ton ; and since ash is almost purely a waste product there is good reason to suppose that it could compete with kainit even in normal times.

691 – **Action of Free Sulphur on Vegetation.** — BOSINELLI, G., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVIII, Part 3, pp. 175-184. Modena, 1915.

Expériments were begun in 1913 with vetches (*Vicia sativa*), oats (*Avena sativa*) and mustard (*Sinapis nigra*) in pots and in the open, with the object of studying the effects of sulphur in small doses on the yield, and ascertaining, if, owing to a better utilisation of the nitrogen in the soil, the use of sulphur was advisable in practical farming.

The results of the pot experiments show that the increases of yield are constant, but not very considerable and not proportional to the quantity of sulphur used; indeed the greatest increases in yield sometimes correspond to the smallest dressings of sulphur. Determinations of protein did not reveal any influence of sulphur on the formation of albuminoids

Experiments in the open in 1913 did not give any reliable results; they were repeated in 1914 with maize, oats, French beans, vetches, mustard and rape. Sulphur gave only a very slight increase of yield, and in the case of mustard even a decrease.

No evidence was obtained that sulphur has any effect upon the formation of chlorophyll. Experiments were devised to test the suggestion of E. BOULLANGER and M. DUGARDIN that sulphur causes the transformation of organic nitrogen into ammonia compounds. These experiments show that in reality sulphur accelerates the above transformation, but only to a very limited extent, and that the action soon ceases; hence its practical utility seems very doubtful.

692 – **Radium Fertilizer in Field Tests.** — HOPKINS, CYRIL G., and SACHS, W. H. (University of Illinois), in *Science*, Vol. XLI, No. 1063, pp. 732-735. Lancaster, Pa., May 14, 1915.

A series of field trials were conducted at the University of Illinois during the seasons 1913-1914 with the object of testing the effects of radioactive fertilizers as crop stimulants. The manures used were prepared by the Standard Chemical Company of Pittsburg and were applied both in the form of radium barium chloride solution and of solid radium barium sulphate, during the spring of 1913. Maize was grown on the land that same season and soy beans the following season. Though the dressings varied in amount from 0.01 mgm. of radium per acre to a hundred times that amount, in no case was a consistent increase in crop obtained and the writers points out that as long as the present prices prevail, the use of radium fertilizers cannot prove an economic possibility, inasmuch as an effective application such as that mentioned by Fabre of 1 ½ microcuries for each space 4 inches square by 8 inches high would cost about $ 58 800 per acre.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

693 – **Morphology of the Barley Grain with Reference to its Enzyme-secreting Areas.** — MANN, ALBERT (Plant Morphologist) and BARLAN, H. V. (Agronomist in charge of Barley Investigations) in *United States Department of Agriculture, Bulletin* No. 183, 32 pp., 7 plates. Washington, April 13, 1915.

This is an exhaustive study of the barley grain, both at rest and in germination, carried out on American, European and Asiatic barleys. The following is a summary of results.

The integuments that envelop the ripened seed of barley arise from four sources: 1) the nucellus, 2) the true integuments, 3) the walls of the ovary and 4) the glumes. Of these only one has any function other than the protection afforded by dead tissue. The investing membrane of the nucellus develops into the semi-permeable membrane, which is found to have remarkable selective powers.

In the development of the barley grain the endosperm develops earlier and more rapidly than the embryo, but is the last to be completed, inas-

much as starch infiltration continues until the parent plant has ceased to live. The first starch is laid down in the centre of the flanks of the grain. Infiltration of starch takes place in centrifugal order. At maturity the starch is less dense about the periphery of the endosperm than in the centre. The embryo occupies a lateral position with reference to the endosperm at the proximal end of the grain. The epithelial layer is not functional until near maturity.

During germination the embryo utilises the food stored in the endosperm. The conversion of the endosperm is effected by the enzymes secreted by the epithelial layer of the scutellum. Conversion proceeds slowly towards the distal end, working more rapidly through the layers lying immediately beneath the aleurone layer. Cytase and diastase must both proceed from the scutellum, and the proteolytic ferments most probably owe their origin to the same organ.

The aleurone layer is not a secreting organ. Its function is probably mainly a protective one.

The greater diastatic power of small-berried barleys is due to the fact that the secreting area is proportionately larger. The area of the epithelial layer as a part of the surface of a spheroid must decrease less rapidly than the volume of the endosperm as the size of the barley grain is lessened.

The efficiency of conversion depends upon the shape and composition of the grain and upon the relative quantity of diastase secreted. The quantity of diastase in turn is dependent upon the size, vigour and condition of the epithelial layer. The greatest secreting area for a given grain is secured with a scutellum extending well over the edges of the adjacent endosperm, the greatest vigour in an epithelial layer of long, narrow cells, the highest condition of efficiency in a well-matured, well-cured grain.

The ideal grain of barley is one that is broadly oval with a scutellum of the type described. If a large yield of malt extract is desired, the size of the grain should be large ; if diastase be the main consideration, the size should be smaller.

Barley grains with pointed ends and a narrow scutellum are to be avoided. Poorly matured grain should also be avoided.

The highest type of the barley grain is secured only when climate, culture and variety are all favourable.

Pedigreed varieties are essential for securing barleys of superior morphological and physiological quality. Such varieties must for the most part be produced in the country, as imported pedigreed stocks are seldom satisfactory.

694 — **A New Theory of the Feeding Power of Plants.** — TRUOG, E. (Department of Soils, Wisconsin Experiment Station), in *Science*, Vol. XLI, No. 1060, pp. 616-618. Lancaster, Pa., April 23, 1915.

It has long been known that different species of plants show considerable differences in their power of obtaining the various nutrient materials from the soil. Since phosphates in an available form are generally lacking in soils, they are suitable as an indication of the feeding power of plants. They are also of considerable economic importance.

Assuming that the availability of raw rock phosphate in the soil is dependent upon the reaction expressed by the equation

$$Ca_3(PO_4)_2 + 2H_2Co_3 \rightleftarrows Ca_2H_2(PO_4)_2 + CaH_2(CO_3)_2$$

the direction of which is determined by the quantities of the products of the right-hand side, it follows that the amount of soluble phosphate produced depends upon the amount of calcium bicarbonate removed either by the plant or by other causes. The writer was therefore led to formulate the following hypothesis:

Plants containing a relatively high calcium oxide content have a relatively high feeding power for the phosphorus in raw rock phosphate. For plants containing a relatively low calcium oxide content the converse is true.

A calcium oxide content less than 1 per cent may be considered relatively low. In this class are maize, oats, rye, wheat and millet. A calcium oxide content above 1 per cent may be considered relatively high. This class includes peas, beans, clover, alfalfa, buckwheat and Cruciferae.

On this theory it is possible to predict from an analysis of the ash of a plant whether a soluble phosphatic manure is required. Under natural conditions other factors may affect the availability of the phosphate; thus ammonium salts increase its availability, since calcium bicarbonate is more soluble in a solution of ammonium salts and is therefore removed from the seat of reaction.

It is also possible that the theory may be applied to the feeding power of plants in a broader way, involving the use of other insoluble plant-food materials besides rock phosphates. The theorem would then be worded as follows : The feeding power of a plant for an insoluble substance depends primarily upon two conditions, *viz*: 1) the solubility of that substance in carbonated water, and 2) whether or not the plant removes from solution all the products of the solubility reaction in the proper proportion, so as to allow the reaction to continue indefinitely.

695 – **Influence of Phosphorus and Magnesium on the Formation of Chlorophyll.** — MAMELI, EVA, in *Atti della Reale Accademia dei Lincei, Rendiconti*, Vol. XXIV, Part 7, 1st Half-Year, No. 7, pp. 755-760. Rome, May 6, 1915.

From cultures of maize (*Zea mais*) and buckwheat (*Polygonum fagopyrum*), *a*) in complete nutritive solutions, *b*) in solutions without phosphorus, *c*) in solutions without magnesium, STOKLASA, SEBOR and SENFT concluded that phosphorus forms part of the chlorophyll molecule, and that chloroplasts cannot be formed without it. On the other hand the important researches of WILLSTÄTTER on the chemical composition of chlorophyll showed that pure chlorophyll does not generally contain phosphorus, or if it contains any it is in mere traces due to impurities. The formation of chlorophyll would therefore be independent of phosphorus. This contradiction has suggested to the writer to repeat the experiments of STOKLASA, which gave results differing from other observations previously published by the writer.

The new experiments, which were first made with the solutions used

by STOKLASA, gave results contrary to those announced by STOKLASA and his colleagues, and confirmed, as regards magnesium, the previous experiments of the writer. But the poor development of the plants in the complete nutritive solution suggested a repetition of the experiment with other nutritive solutions, which yielded the following results:

1. Vigorous development and intense green colour of the plants in the complete solution (water 1000 gms., calcium nitrate 1 gm., potassium nitrate 0.25 gm., acid potassium phosphate 0.25 gm., ammonium sulphate 0.25 gm., magnesium sulphate 0.25 gm., iron sulphate 0.02 gm.).

2. Fair development and pale colouring, almost etiolated, in the same solution but without magnesium sulphate.

3. Reduced development and intense green colour of the plants in the same solution without phosphate.

Thus this series of experiments also yielded results contrary to those set forth in STOKLASA'S recent work. They contradict the lecythinic theory of the composition of chlorophyll and agree with the analytical results obtained by WILLSTÄTTER and his collaborators as to the presence of magnesium and the absence of phosphorus in the chlorophyll molecule.

696 - **Chemical Poisoning and Mutation in Maize.** — JUNGELSON, A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 15, pp. 481-483. Paris, April 12, 1915. PLANT BREEDING.

The writer obtained abnormal ears of maize from sound or damaged seeds which had been kept from 1 to 24 hours in contact with a 1 to 2 per cent water solution of electrolytic copper sulphate. For the experiment a variety of white King was used. Whilst the normal ears are long and cylindrical with parallel rows of seeds, the abnormal ones showed: 1) twisted rachis; 2) cylindro-prismatical shape; 3) pear shape; 4) dwarfed appearance; 5) curved shape; 6) bowed shape; 7) very few seeds; 8) deformity, that is amorphous rachis and covered with sterile seed; 9) androginity. The percentage of abnormal ears produced in each group was as follows:

Treatment of the seed	Percentage of abnormal ears
Intact and poisoned	14.9
Deprived of tegument and poisoned	20.0
Scratched and poisoned	37.0
Mutilated and poisoned	35.4
Intact, or deprived of tegument or scratched or mutilated, but not poisoned	0.0

Hence poisoning the seed has given the plant the property of producing new forms.

697 - **The Inheritance of a Recurring Somatic Variation in Variegated Ears of Maize.** — EMERSON, R. A., in *Bulletin of the Agricultural Experiment Station of Nebraska*, No. 4, pp. 5-35. Lincoln, Nebraska, February 1914.

The seeds used in these experiments were obtained from local and national exhibitions and nothing was known as to their parentage or pollination.

The parentage of the red, variegated and white grains of any one ear was obviously the same and it is reasonable to suppose that the different sorts of grains in any one ear were pollinated with approximately the same kind or the same mixture of pollen.

Breeding experiments with these seeds showed: 1) that the more red pigment there is in the pericarp the more frequently do red ears occur in the progeny; and 2) that such red ears behave just as if they were F_1 hybrids between red and variegated or red and white races, the behaviour in any case depending upon whether the parent variegated ears were homozygous or heterozygous for variegated pericarp and whether they were self-pollinated or crossed with white.

The writer concludes that the occurrence of self-colour as a somatic variation is due to the change of a Mendelian factor for variegation into a factor for self-colour. The subsequent behaviour of these variations in later generations then becomes a matter of simple Mendelian inheritance.

These results are interpreted as follows: the genetic factor, V, for variation, is changed to a self-colour factor, S, in a somatic cell; all pericarp cells directly descended from this modified cell will develop colour; and of the gametes arising from such modified cells, one-half will carry the S factor and one half the V factor if only one of the two V factors of the somatic cells is changed, or all such gametes will carry S if both V factors are changed.

698 – **Pure Strains of Wheat with more or less Complete Self-Fertilisation.** — Nilsson-Ehle, H., in *Zeitschrift für Pflanzenzüchtung*, Vol. III, Part 1, pp. 1-6. Berlin, March 1915.

The writer carried out experiments to solve the questions of the influence of heterogamy on variation in wheats.

The following wheats were sown in 1910 in alternate rows: 1) Pudelweizen (characterised by white, hairy, fairly dense ears and white grain) liable to degenerate; 2) Schwedischer Sammetweizen (characterised by white, hairy, lax ears and red grain); and 3) strain No. 0728 of local origin (characterised by a hairless, brown, lax ear and red grain) which formerly had always shown a surprising purity in its characters. Five rows of Pudelweizen and four rows of Schwedischer Sammetweizen were sown alternately with the rows of No. 0728 at 6 inches apart. Each row consisted of 30 grains sown in pairs at a distance of 2 inches. At harvest time four different groups were made, *viz.*: 1) the rows of Pudelweizen; 2) the rows of Schwedischer Sammetweizen; 3) the rows of No. 0728 alternating with those of Pudelweizen; 4) the rows of No. 0728 alternating with those of Schwedischer Sammetweizen.

In 1912 all the grains from each group were sown singly at 2 inches apart in rows 6 inches apart. The results of this experiment were as follows:

Pedigree	Total number of plants	Number of hybrids with brown and hairy ears
1. Rows of Pudelweizen	777	7
2. » » 0728 alternating with 1	610	0
3. » » Schwedischer Sammetweizen	615	3
4. » » 0728 alternating with 3	611	0

From these results it follows that a certain number of plants of Pudelweizen and Schwedischer Sammetweizen were fertilised in 1911 by No. 0728, whilst the latter showed no effects of cross-pollination. The seeds of the hybrids of both crosses were sown and in 1914 segregation of characters was observed as follows : brown-white, hairy-smooth, etc. It was therefore evident that the plants with brown and hairy ears were natural hybrids due to pollen from No. 0728.

This difference in adaptation to fertilisation may be due in certain cases to the difference in flowering period between the different varieties of wheat. In this particular case, however, the flowering periods of the three varieties were almost identical.

Similar differences in the tendency to heterogamy have already been observed in different races of cultivated plants, especially barley, rice and rye. With regard to wheat this phenomenon accounts for the different observations made by plant breeders with regard to the frequency of natural hybridisation in wheat, since these observations concern a very large number of the most diverse varieties of wheat.

The different susceptibility to hybridisation is very probably a most important source of the unequal degeneration of different varieties of wheat, though it may not be the determining factor. There are undoubtedly spontaneous mutations also, due to the change from the dominant to the recessive condition, in both wheat and oats. Thus, for example, there may be as a result of this change awned forms in an awnless variety. Such spontaneous mutations will be much less frequent in the varieties with characters depending on the simultaneous presence of two factors than among those with single-factor characters. It is for this reason that the apparent degeneration of different races of wheat may take a different appearance.

699 – **Correlation between the Yield of Grain and the Weight of 1000 Grains in Wheat.** — GRABNER, EMIL, in *Zeitschrift für Pflanzenzüchtung*, Vol. III, Part 1, pp. 7-18. Berlin, March 1915.

In determining the practical value of new strains of wheat it is very useful to take into account characters other than the yield per acre. The best character for this purpose is the weight per 1 000 grains, which has a positive correlation with the yield of grain.

This correlation is generally apparent in field crops, though there are some exceptions.

It can be observed : 1) in different varieties grown in different seasons and different regions ; 2) in different varieties grown in the same season ; 3) in any particular variety grown in different seasons and under differing cultural conditions.

In illustration of this the writer gives several tables of results obtained with different varieties of selected Hungarian wheats and other well-known varieties of wheats. Exceptions to this rule can always be explained by abnormal influences. It follows that this correlation is of considerable value as a means of control in determinations of the cultural value of different selected varieties of wheat. Further, examination of the cases

of exception to this correlation would be useful in finding mistakes in the organisation of experiments, as well as influences disturbing their normal course.

The writer also discusses the question of the relative merits of the weight per unit volume and of the weight per 1 000 grains in establishing this correlation. He finds that the latter determination is to be preferred, because the exact determination of the weight per unit volume presents more difficulties. However, the same correlation exists, though with more exceptions, between the weight per unit volume and the yield of grain.

700 – **Contribution to our Knowledge of Cultivated Varieties of Winter Rye.** — GRUNDMANN, in *Zeitschrift für Pflanzenzüchtung*, Vol. II, Part 1, pp. 27-41. Berlin, March 1915.

From the results of variety trials carried out since 1910 at the Plant Breeding Station of the Agricultural Institute of the University of Halle a. S., the writer gives a description of the principal morphological and physiological characters and the yield capacity of 21 varieties of winter rye, comprising the most important cultivated varieties grown in Germany. They are divided into three groups according to the density of the ear as determined by the length of rachis and number of spikelets per unit length of the ear, thus: 1) lax-eared; 2) ears of average density; 3) dense-eared.

The *lax-eared varieties* are generally distinguished by very large ears and strong robust stems with abundant foliage. The long, heavy ears completely counterbalance the weak tillering, so that these varieties are heavy yielders of both grain and straw. They have, however, the disadvantages of requiring a long growing-period and an abundant supply of water.

The *varieties of average density* are more adaptable as regards conditions of soil and climate than the former. Their straw is long or of average length and generally not very strong, so that many of them are liable to lodge; this is especially the case with those varieties combining long stems with high tillering power. None of them have a low tillering power, and those of high tillering power are generally early-maturing varieties. Several give very high yields, whilst others give poor yield of both straw and grain. The individual yield of some of these varieties is very poor.

The *dense-eared varieties* are adaptable as regards conditions of soil and climate, and have moderate tillering power and high or very high yielding capacity. They are resistant to lodging, on account of their short straw, which is well able to support the short and heavy ear. The period of growth varies very much.

As a result of his observations, the writer gives the following rules bearing on the breeding of rye.

1. Very early ripening may be combined with maximum yield of straw and average yield of grain.

2. Moderately early ripening may be combined with maximum yield of grain and medium yield of straw.

3. Late ripening may be combined with maximum yields of both grain and straw.

4. Marked earliness is always associated with average to very high tillering power.

5. Very high tillering power is generally associated with thin culms and weak resistance to lodging, especially with tall varieties.

6. Green grains have a higher percentage of protein than yellow grains, and large grains have a higher percentage than small grains.

7. The weight of 1 000 grains is greater for green than for yellow grains.

8. Yellow-grained varieties have a greater percentage of leaves than green-grained varieties.

9. Plants grown from green grains have a higher individual yielding capacity with regard to grain and straw then those from yellow grains.

10. Strains with pure grain-colour may be produced after only three years of selection. Green is dominant to yellow, the F_1 hybrid between them being grey-green. Complete segregation takes place in the F_2 generation.

11. Selection of the grains according to their size and purity of colour does not result in improvement. Increased yield is only obtained by the selection of individuals and pure lines.

As an appendix there is a description of a process for the examination of the cultural qualities of winter rye.

701 – **Researches on the Conditions of Pollination and Fertilisation of Red Clover in Holland.** — MAYER, GMELIN H., in *Zeitschrift für Pflanzenzüchtung*, Vol. III, Part I, pp. 67-75. Berlin, March 1915.

The writer carried out experiments on the conditions of fertilisation of six different varieties of red clover (*Trifolium pratense*) at the Plant Breeding Station of Wageningen (Holland) in 1914. The plants were grown in the open at distances of 12 in. each way, and produced a good crop of seeds whose colour varied even in plants of the same variety and in individual plants.

The inflorescences of 41 plants were isolated by small gauze-covered cages, with from 10 to 15 in each cage. Thirty-eight of these plants produced no seeds, and the remaining three plants produced respectively 1, 1 and 7 seeds, the latter showing incomplete development.

In a second series entire plants were isolated in cages into which bumble-bees were introduced. In this case 3 plants produced no seed, 2 plants 1 seed each and 5 others respectively 12, 67, 83, 116 and 264 seeds. Most of the seeds of the last two plants showed only incomplete development. Perhaps the somewhat better results of this experiment were due to the fact that the bees introduced carried pollen from other clover plants.

In a third series of experiments the plants were isolated in pairs and bumble-bees were again introduced into the cages. This time the plants produced seeds in abundance; thus, for example, of two plants isolated together, one having 35 inflorescenses produced 1207 seeds and the other with 104 inflorescences produced 5678 seeds; two other plants produced 3847 and 3475 seeds respectively.

The writer concludes that the almost complete sterility of red clover

from self-pollination is again demonstrated by these experiments, and that it is not too difficult to produce by means of continued isolation of plants in pairs and the introduction of bumble-bees, new types of red clover with uniform fixed characters.

702 – **Individual Selection in the Formation and Fixing of Varieties and Types of Mangels.** — TRITSCHLER, in *Zeitschrift für Pflanzenzüchtung*, Vol. III, Part 1, pp. 19-25. Berlin, March 1915.

The question whether the artificial self-fertilisation of beets, plants naturally heterogamous, involves a change in the constancy of typical characters, or whether the method of individual selection renders the same character more constant, has not yet been satisfactorily settled from a scientific point of view. The writer gives the results of his observations on this question with respect to Eckendorf mangels ; it was desired to obtain greater fixity of the cylindrical type, which gives the highest yields.

In these experiments the best shaped mangels from a single parent plant were set out separately and surrounded by gauze (individual selection) or planted in isolated groups (mass selection) and the percentage of mangels of the typical shape was determined in each generation. For example, the following percentages were obtained for beets of the cylindrical form :

	per cent
In the offspring of the 9 best rows planted in one isolated group	65.0
» » » of selected individuals, first generation	55.5
» » » » second »	55.6
» » » » third »	53.1
» » » » fourth »	51.5

Thus, the percentage of typical cylindrical roots diminished with each selection. Though this diminution is not very great, it appears much more serious when one considers that the selections are made from the most typical roots in each generation, especially so when compared with the percentage of typical roots obtained from the 9 best roots planted in an isolated group with opportunity for cross-pollination.

In another series of trials the best roots in a direct line from several parents were planted in groups after individual selection for one, two or three generations. The percentages of typical beets obtained in this manner are given in the following table :

4 generations	all isolated	43 ; 52.2	47.1 ; 40.1	47.9 ; 57.4	56	—
	isolated in 3 generations, then planted in one group	— 56.2	— 66.7	— 62.6	57	—
3 generations	all isolated	50.8	48.5	47.1	58.3	41.7
	isolated in 2 generations, then planted in one group	55.4	60.6	54.9	59.0	63.1
2 generations	both isolated	53.4 ; 60.7	57.9 ; 46.8	55.9 ; 57.6	42.2	50.5
	isolated in one generation, then planted in one group	— 54.4	— 47.4	— 68.4	58.9	52.8

With a few exceptions, an increase in the percentage of typical roots occurs with the adoption of group selection. Also the difference between the percentage of roots isolated in several generations and of roots selected in groups after isolation increases in proportion to the number of isolated generations.

Other combinations of individual selection and selection by group (*e. g.* the two methods alternating) afford further proof that selection by individuals is not able to produce any improvement in form or increase of the constancy of typical characters of a particular variety of mangels, but that the contrary seems rather to be the case. The question whether the changes of the unstable type of mangels are due to self-fertilisation or to bad conditions of growth caused by isolation can only be settled by experiments carefully carried out on scientific lines, though the favourable results obtained by selection in groups resulting in heterogamy seem to indicate self-fertilisation as the cause of this change.

On the other hand it is well known that individual selection in mangels is successful in producing a high content of dry matter or fixing some other character, provided the external characters are not seriously changed. Such strains furnish excellent material for hybridising work, which, when carried out with a definite object, is the best means of obtaining and fixing new varieties and types. For this reason the writer recommends individual selection, in spite of the change in the typical form which this method produces.

703 - **Tobacco Mutations in Connecticut**. — HAYES, H. K. (Associate Professor of Plant Breeding, University of Minnesota), in *The Journal of Heredity*, Vol. VI, No. 2, pp. 73-78, 2 plates. Washington, D. C., February 1915.

The type of tobacco known as Connecticut Cuban Shade was first introduced into America in 1904 from Cuba. A selected strain of this variety has been grown continuously since then and has shown considerable evidence as to its homogeneity. Selection for high leaf-number during four years did not raise the mean from its original number 19.9. During the harvest of 1912 certain plants were observed with a large number of unpicked leaves and no inflorescence. These were removed to a glasshouse where they blossomed in January and bore 72 leaves on the stem. Seed from these new types sown in 1913 produced plants of uniform appearance but differing from the normal Cuban in having leaves of a somewhat lighter green shade, in a partial absence of green suckers and in a practically indeterminate growth. Whereas the normal Cuban type bears a terminal inflorescence after producing 14 to 25 leaves, this new type blossomed in November after producing from 60 to 82 leaves per plant. In 1913 this new type, known as "Stewart Cuban", was grown as a field crop and manufactured by the Windsor Tobacco Corporation. The quality of the leaf was equal to the normal type and its yield 90 per cent higher. Owing to its prolonged period of growth seed cannot be obtained without transplanting to a greenhouse in the late autumn.

Other mutations giving a higher leaf-number and an abnormal growing season have been observed in the case of Connecticut Havana, which

has shown a uniform type for over 50 years. The same mutation has appeared in different parts of the country, but has only appeared for a single generation.

AGRICULTURAL SEEDS

704 – **Determination of the Mean Weight of the Grain as a Control of the Quality of Rice suitable for Export from Java.** — KOCH, L., in *Korte Berichten voor Landbouw, Nijverheid en Handel*, Year V, No. 5, pp. 75-79. Buitenzorg, March 1915.

In addition to complaints of the diminished yield of imported varieties of rice, the exporters have complained of decrease in the size of the grains. The former appeared not to be impossible, but the second, resulting from degeneration, appeared much less probable, at least in cases in which care is taken to plant pure varieties.

The writer has not observed any degeneration, either sudden or gradual, during several years' cultivation of Carolina rice near Batavia. Experience with 1 000 cultivated varieties of rice in the plant-breeding station at Buitenzorg during the last eight years has not shown any diminution in the size of grain. The greatest fluctuation of mean weight of grain was less than 1 mgm. It is very probable that where considerable fluctuations occur they are due to a mixing of the varieties.

It has also been suggested that the greater precision of rice milling machinery may have resulted in smaller weight of the larger grains than formerly, when the machines were less perfected. This supposition has also been shown to be groundless.

The writer proposes to remedy this degeneration by accurate weighing of the samples on the market which have been valued at sight. Such a control will help to remove the bad practice of mixing superior with inferior varieties of rice and increase the attention to pure planting.

705 – **Impurities in Seeds in Victoria, Australia** (1). — *Communicated by* S. S. CAMERON, *Director of Agriculture.*

Report of seed examined in February and March 1915.

Kind of seed	Country of origin	Weed seeds: Species	Weed seeds: Percentage	Percentage of non-germinable seeds	Percentage of diseased seeds	Quantity examined
Lucerne (*Medicago sativa*) *	United States	*Cuscuta* sp.	0.11	1.09	*nil*	3 oz.
		Polygonum aviculare	0.02			
		Brassica campestris	0.01			
Lucerne (*Medicago sativa*) **	United States	*Cuscuta* sp.	0.05	1.80	*nil*	3 oz.
		Brassica campestris	0.06			

* Also contained 0.29 per cent of loading. — ** Also contained 0.19 per cent of loading.

(1) See also *B.* May 1915, No. 487. (*Ed.*)

706 - **The Proportion of Grain to Straw in Australian Varieties of Wheat.** — PRIDHAM, J. T., in *The Agricultural Gazette of New South Wales*, Vol. XXVI, Part 3, pp. 228-230. Sydney, March 1915.

Since wheat is grown in Australia both as a grain and as a hay crop according to local circumstances, it is important to know the suitability of each variety for these purposes. The writer therefore carried out field experiments to determine the "migration ratio", *i. e.* the proportion of grain to straw, in 40 Australian varieties of wheat. The value of the ratio varies from 0.57 in the case of a new hybrid Yandilla King × Indian to 0.23 in the case of Zealand. The selection of varieties with a low ratio like Zealand is of great value in districts where wheat is grown for fodder. With regard to the varieties with a high ratio, it was found that there was no correlation between the yield of grain and "migration ratio", so that it is necessary to compare wheats from both points of view.

CEREAL AND PULSE CROPS

707 - **Nitrogenous Manures in Wheat Growing.** — MALPEAUX, L. (Director of the Pas-de-Calais Agricultural College), in *La Vie agricole et rurale*, Year IV, No. 46, pp. 416-418. Paris, April 10, 1915.

The writer lays stress upon the expediency of increasing wheat production at the present time and shows the necessity of having recourse for this purpose to the liberal use of soluble fertilisers, especially in the case of crops sown late or injured by frost. He considers that the application of nitrogen

Manures and crops, in lbs. per acre.

Fertilisers	Dates of application											
	Nov. 15		Dec. 15		Jan. 15		Feb. 15		March 15		April 15	
	Yield		Yield		Yield		Yield		Yield		Yield	
	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain
Control	5 130	2 150	4 900	2 120	5 100	2 140	5 020	2 180	5 100	2 190	5 800	2 140
Nitrate of soda, 90 lbs.	5 390	2 250	5 000	2 300	4 700	2 330	5 350	2 450	5 460	2 410	5 800	2 430
Nitrate of soda, 180 lbs.	5 580	2 860 *	5 500	2 150 *	5 500	2 140	5 800	2 440	5 600	2 090 *	5 810	1 870 *
Sulphate of ammonia, 67 lbs. . . .	5 130	2 270	5 200	2 140	5 000	2 300	5 600	2 360	5 590	2 250	5 600	2 140
Sulphate of ammonia, 135 lbs. . . .	5 440	2 300	5 450	2 410	5 100	2 100	5 450	2 240	5 600	2 140	5 800	1 920 *
Nitrate of soda, 45 lbs. . . . . Sulphate of ammonia, 31 lbs. . . .	5 580	2 300	5 350	2 190	5 350	2 250	5 400	2 280	5 450	2 300	5 350	2 070

* Plots lodged.

is particularly efficacious at the tillering period ; it also increases resistance to disease, and is especially useful in the case of " straw-blight ". While nitrate of soda is preferred for top-dressing, in view of the possible loss of nitric nitrogen by leaching, sulphate of ammonia is recommended for autumn use. Nevertheless, the loss of nitric nitrogen is not always certain, as is shown by the experiments of the writer and LEFORT following those of MÜNTZ and GAUDECHON (1). The writer therefore made applications of nitrate of soda compared with sulphate of ammonia at various dates on series of plots in a field sown with wheat in October 1912. The arrangement of the plots and the results obtained are given in the accompanying table.

February appears to be the best month for the application of both sulphate of ammonia and nitrate of soda ; though there was some loss with autumn dressings of nitrate of soda, sufficient remained to induce lodging in the case of the heaviest dressing. Other experiments have shown that a light dressing of nitrate before sowing helps the plant to resist the winter ; a dressing of 45 lbs. per acre is specially to be recommended where the wheat is got in late after mangels, the rest of the dressing being given in spring, but not too late. Sulphate of ammonia may equal nitrate of soda on light land containing lime : here again late top-dressing should be avoided, as it may induce lodging.

708 – **The Manuring of Rice Seed-beds in Bombay**. — GONEHALLI, V. H. (Deputy Director of Agriculture in the Konkan, Bombay Presidency), in *Annual Report of the Department of Agriculture, Bombay Presidency*, 1913-1914. Bombay, 1915.

In the ráb system of growing rice, organic manures are burnt on the seed-beds, but owing to the scarcity of materials such as dung, loppings of trees, etc., the seed-beds are often insufficiently burnt. Experiments were therefore tried to determine a more efficient means of using the ráb materials, since the application of substitutes without the burning process failed to realise two important advantages of the burning system, *viz.*: the destruction of weeds and the easy uprooting of the seedlings.

It was found that the effects of the burning are apparent during the following year and that by burning one-half of each seed-bed each year the desired economy and efficiency could be obtained.

Manures were applied to the seed-beds at the rate of 100 lbs. of nitrogen per acre and the following results obtained :

Treatment of seed-bed	Yield in lbs. per acre of field	
	Grain	Straw
1. Cowdung ráb (burnt)	1880	3200
2. Fish manure applied to seed-bed burnt the previous year	1840	2800
3. Karanj cake applied to seed-bed burnt the previous year	2200	2600
4. Urine earth applied to seed-bed burnt the previous year	2040	2800

(1) See *B.* March 1914, No. 205. (*Ed.*)

Thus, the practice of imperfectly burning all seed-beds may be replaced by one in which the whole available supply of materials should be burnt on as much of the area of seed-beds as it is sufficient for, and the remaining area treated with ordinary manure.

709 – **Scientifically devised and Commercial Seeds Mixtures for Pastures.** — HEINRICH, M., in *Fühlings Landwirtschaftliche Zeitung*, Year 64, Part 7-8, pp. 187-200. Stuttgart, April 1 and 15, 1915.

To determine the composition of a good seeds mixture it is necessary to have an exact and complete knowledge of forage plants; it is not sufficient to know the high or low forage value of a plant in an absolute sense; its requirements with regard to soil and climate, its duration, manner of growth and the period of greatest value as forage must also be known. The writer indicates the procedure and the points to keep in view in the choice of the plants which should enter into the composition of a seeds mixture, in order that it will answer its purpose under the given conditions.

I. — Duration of pasture: *a*) 1 to 2 years; *b*) up to 5 years; *c*) of indefinite length.
II. — Kind of pasture: *a*) production of forage, dry or green; *b*) grazing; *c*) production of hay followed by grazing.
III. — Kind of stock: *a*) horses, *b*) cattle, *c*) sheep, *d*) pigs.
IV. — Humidity (level of water-table, rainfall): *a*) wet soil; *b*) moist soil; *c*) dry soil; *d*) soil irrigated by flooding; *e*) soil irrigated on the catchwork system,
V. — Nature of soil (suitability for clover, lime content): *a*) peaty soil; *b*) mineral soil (clay, loam, sand, gravel), light, medium or heavy.
VI. — Climate: *a*) exposed to extremes; *b*) protected against extremes.
VII. — Situation (elevation above sea-level): *a*) exposed slope; *b*) sheltered (surrounded by woods).

Thus, for example, supposing a seeds mixture is required for pasture of an indefinite period, for sheep grazing on dry light sandy soil with a low water-table and a rainfall of 20 inches, in a region exposed to extreme conditions and in an open situation at an altitude of 90 ft. above sea-level, a search will be made for all plants possessing the required qualities. They must be perennials resistant to grazing and trampling of animals. Since the grazing is for sheep, inferior plants unsuitable for cattle may be admitted. Further, the plants must not be exacting with regard to soil and climate. The writer enumerates the plants suitable for such a mixture. Some of these plants may be eliminated for special reasons, such as difficulty of obtaining pure seeds at a reasonable price.

The proper proportions of these species then require consideration; as a general rule the bottom grasses should form 60 per cent of the mixture and top grasses and clovers the remaining 40 per cent. The mixture should include grasses of tufted habit and others of creeping habit, so as to obtain a dense continuous sward.

Commercial mixtures cannot answer to the requirements of a good seeds mixture with regard to either the different species or the proportion of each in the mixture, considering the very variable conditions of

soil and climate and the different purposes for which each mixture is required. Though the price of commercial mixtures generally appears very low, in comparison with their utility it is actually much too high.

FIBRE CROPS

710 – **A New System of Cotton Culture and its Application**. — Cook, O. F., in *U. S. Department of Agriculture, Farmers' Bulletin* No. 601, 12 pp. Washington, 1914.

The system which is here described and recommended has been successfully tested in several localities of the United States, both by the Bureau of Plant Industry of the Department of Agriculture and by practical farmers.

The way to secure an early short-season crop of cotton is to thin the plants later and leave them closer together in the rows than is now customary. Neither of these policies is advisable if used alone, but they give a real advantage when properly combined. Keeping the plants closer together during the early stages of growth restricts the formation of vegetative branches and induces an earlier development of fruiting branches.

The spacing of the plants and the stages at which thinning should be done will depend upon local conditions and will have to be determined experimentally in every case.

So long as the plants are close together they do not form vegetative branches; hence by thinning them when the stalks have grown beyond the stage in which vegetative branches are produced, the latter are controlled or suppressed. This makes it possible to leave more plants in the rows than is now customary and yet avoid injurious crowding.

The control or suppression of the vegetative branches also permits an earlier development of fruiting branches and leads to the production of an earlier crop. In regions where the period of crop production is limited either by short seasons or by the presence of the boll weevil, increased earliness is a means of securing larger yields. Hitherto no other way has been suggested whereby it is possible for the farmer to gain such direct control of the behaviour of his crop and to ensure larger yields in short seasons. The danger of weevil injury is greatest under conditions that favour the luxuriant growth of the young plants and induce the formation of large numbers of vegetative sterile branches, and it is under such conditions that the control of the formation of branches becomes most effective as a method of weevil resistance.

711 – **The Classification and Grading of Cotton**. — Earle, D. E., and Dean, W. S. (Office of Agricultural Technology and Cotton Standardisation), in *U. S. Department of Agriculture, Farmer's Bulletin* No. 591, 23 pp., 16 figs. Washington, D. C., 1914.

The full grades of cotton in both American and European markets are as follows :

Fair Middling Fair Good Middling	Middling	Low Middling Good Ordinary Ordinary.

The American half grades are obtained by prefixing " Strict " to each of these full grade names and the European half grades by prefixing " Fully ".

The word " Barely " is used in both continents to present the quarter grade below.

The United States Department of Agriculture has prepared cases of standard grades for distribution to the principal cotton centres. These standards are compared with a permanent standard consisting of 50 sets of the official grades stored in large vacuum tubes. There will therefore be no changing of the standards from year to year as formerly.

The grades Low Middling, Middling and Good Middling cover the bulk of white cotton grown in an average season, and a knowledge of these three grades is usually sufficient for the grower's use.

Factors influencing the grades of cotton.

Leaf, dirt and sand. — The presence of these impurities in the crop is dependent on the weather. An early frost before picking kills the vegetation and dead leaves become mixed with the crop. Dirt and sand are introduced by wind and rain. The use of up-to-date machinery removes these impurities and leaves little cotton below Low Middling.

Motes are immature seeds or ends of seeds that are pulled off in the ginning. Their number depends upon the variety and weather conditions during maturity.

Neps and cut fibres. — These are small white dots and bunches caused by feeding the gin too fast, by using a gin in bad order, or by the presence of unripe or damp fibre. Cotton containing these defects is generally reduced in value from 1 to 3 cents per lb.

Stringy cotton. — This is also due to unripe or damp cotton and sometimes to a wrong adjustment of the brushes in the gin.

Cut seeds. — These are caused by fast ginning with a hard roll and by broken or bent gin-saw teeth.

Unripe fibres have a glossy appearance and are usually matted together. They are very weak and lower the value of the grade.

Colour. — The factors influencing colour are weather and soil. Early pickings should have a bright creamy colour. If left too long the colour changes to a " dead " or bluish white, and if exposed to rain it may become " tinged " or stained according to the character of the soil. Frost often causes spots, tinges or stains on late bolls before they open. Frosted cotton has a yellowish or buff colour and is usually weaker than other tinged cotton owing to the forced opening of the bolls.

712 - **New or Little-known Tanning Substances.** — LAUFMANN, R. (Deutsche Versuchsanstalt für Lederindustrie), in *Collegium*, No. 541, pp. 197-209. Frankfort-on-Main, May 1, 1915.

CROPS YIELDING OILS, DYES AND TANNINS

A description and analyses of a number of new or little-known vegetable tanning substances of various origins. A table showing their principal characters is appended herewith.

Name	Country of Origin	Tannin — per cent.
« Cuero » bark (1)	South America	16.8
Cassia or « turvar » bark (*Cassia auriculata* L.)	East Indies	—
« Morocco » wood, similar in appearance and qualities to « quebraco » wood	—	19.0 – 22.6
Afzelia wood	Unknown	15.2 – 15.7
Pods of « barbatimão » (*Stryphnodendron barbatimao* Mart.)	Brazil	27.0
« Lingue » bark (*Persea lingue* Nees.)	Chili	22.1
« Pangin », probably the pulp of the fruits of an unknown plant	Unknown	20.5
« Guara », ground pods of a kind of « divi-divi » (*Paullina sorbilis* Mart.)	—	51.0 – 55.8
« Carabin », formerly called « vainille »; probably the pods of *Caesalpinia tinctoria* Benth.	—	30.3
Sumac	Turkey	20.5
Sumac	Caucasus	20.0 – 23.0
Leaves of « mangue » or « mange »	Brazil	31.6 – 33.3
« Bablah », pods of *Acacia arabica* Willd.	—	20.2
« Araca » bark (2)	Brazil	18.4
« Cascara » bark, plant unknown	San Francisco	25.0 – 28.5
« Cebil » bark (3)	Argentina	17.0
Elephant roots (*Elephantorrhiza burchelli* Benth.)	—	17.5
« Ganib » roots (*Hydnora longicollis* Welw.)	German South-West Africa	32.0
« Garouille », cortex of roots of *Quercus coccifera* L.	—	—
« Sunlethet bones », fruit of unknown plant, probably one of the *Caesalpineae* :		
pods with seeds		23.6 – 27.2
pods without seeds		51.5 – 56.6

The writer also gives an analysis of *Pistacia lentiscus* L., which is used to adulterate Sicilian sumac.

SUGAR CROPS

713 – **Experiments in Stripping Sugarcane by Hand before Planting**. — ROSENFELD, A. H. (Director, Experiment Station, Tucumán), in *The International Sugar Journal*, Vol. XVII, No. 196, pp. 183-184. London, April 1915.

It is maintained by some authorities that the hard parchment-like leaves of the sugarcane retard the development of the shoots of planted canes and that it is an advantage to remove them before planting On the other hand, other authorities maintain that the dried leaves prevent evaporation from the canes during dry weather. Experiments were begun in 1911 to test this point and after two years' harvests it was found that stripping the leaves had no significant influence on the yield of cane.

(1) Plant belonging to the Malpighiaceae (cf. DEKKER, *Die Gerbstoffe*. Berlin, 1915).

(2) Probably « araçá », a plant belonging to the genus *Psidium* (cf. PEREIRA, H. *Appunti sui legnami dello Stato di San Paolo*. San Paolo, 1910).

(3) *Acacia cebil* Gris. (cf. WEHMER, C. *Die Pflanzenstoffe*. Jena, 1911). (*Ed.*)

714 - **Determination of the Maturity of Sugarcane in relation to its Fungoid and Insect Pests.** — MARX, N., in *Archief voor de Suikerindustrie in Nederlandsch-Indie*, Year XXIII, Part 9, pp. 351-353. Soerabaia, March 1915.

Every sugar manufacturer takes care to harvest his cane only when fully ripe, a state which is determined by testing the sugar content of three different parts of the stem to see if it is uniform throughout. This method is excellent in theory, but in practice it is found better not to wait until the composition of the juice is uniform, since the cane is then liable to be over-ripe. The cane should be cut at the moment when the yields of juice of the lower and middle portion are equal and differ by about one degree from that of the upper portion. A diseased condition of the cane may give rise to an unequal maturation of the stem and influence the increase in yield of juice. In determining the yield by analysis, it is necessary to see if the cane is healthy or affected by disease. In this way is attained the twofold object of determining with greater certainty the state of maturity and of controlling the presence of disease in the plantations providing the cuttings for the formation of new plantations.

715 - **A New Variety of Hop.** — SALMON, E. S. (Mycologist to the South-Eastern Agricultural College, Wye, Kent), in *The Journal of the Board of Agriculture*, Vol. XXII, No. 2, pp. 136-140, figs. 1-6. London, May 1915.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

During 1906 and 1907 one particular hop plant in the experimental hop-garden at Wye College attracted attention by reason of its vigorous growth and prolific cropping qualities. Since then this plant has been propagated and its qualities tested.

It is characterised by dark-green or red blotches on the leaves ; it is very fruitful, matures late, and produces small to medium sized hops of high resin content.

Its great superiority lies in its resistance to the attacks of the eel-worm (*Heterodera schachtii*) to which it is perfectly immune. It is fairly susceptible to "mould" (*Sphærotheca humuli*), but partially resistant to blight (*Aphis*).

Though not sufficiently delicate in flavour for the manufacture of pale ale it is very suitable for replacing foreign hops.

716 - **Comparison of Apple Plantations on Tilled Soil and with Sod Mulch.** — See above, No. 686.

FRUIT GROWING

717 - **Santol (*Sandoricum koetjape*), a New Fruit in the Philippines.** — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. VIII, No. 1, p. 58. Manila, 1915.

The fruits of santol (*Sandoricum kœtjape*) are generally so inferior as to be unsaleable in the markets, but recently mutations have been found the fruit of which rivals in flavour the best fruits of the tropics. Its greatest defects are the large seeds and the adherence of the flesh. The pulp is translucent, separable from the pericarp as in the mangosteen, subacid, juicy and of a vinous, excellent flavour. Its thick tough rind should enable it to be shipped without difficulty.

FORESTRY

718 – **Scots Pine grown in Sweden from Seed from Different Countries: Contribution to the Question of the Influence of Origin.** — SCHOTTE, G., in *Meddelanden från Statens Skogsförsöksanstalt*, Part II, pp. 61-107, 18 figs. Stockholm, 1915.

Three series of acclimatisation experiments with Scots pine (*Pinus sylvestris*) were carried out in Sweden, comparing seed from: *a*) different parts of Sweden ; *b*) Sweden and Germany ; *c*) various countries in Europe.

Series I. — These experiments were a continuation of others already communicated (*Meddelanden från Statens Skogsförsöksanstalt*, VI, 229-238) ; they confirm the fact, previously mentioned by the writer and by ENGLER, that in Scots pines from the most northern latitudes or from the highest alpine districts the needles sooner turn yellow in winter and take on a more decided yellow colour than in those raised from seed of a more southern origin.

Series II. — This series was carried out on heath land in Southern Sweden ; the plots show that trees raised from Norrland seed develop more feebly than those of German origin ; it thus appears that the former are little suited to plantation on the heaths of Southern Sweden, where the trees must be able to dominate the growth of the heath-plants as quickly as possible.

Series III. — These experiments were begun in 1907-08 as the Swedish section of the international series of trials of Scots pine seed from different countries, organised by the International Association of Forestry Experiment Stations. The results obtained were to have been presented in a joint report to the International Congress of Forestry Experiment Stations proposed for September 1914, but on account of the international situation, everything was suspended and only partial results were published. The two accompanying tables show the more important results.

Development of one-year Scots pine seedlings at Sollefteå (lat. 63° N.).

Country of origin of seeds	Percentage of germination in the nursery	Growth of seedlings in length					
		Roots		Shoot		Needles	
		max.	av.	max.	av.	max.	av.
		in.	in.	in.	in.	in.	in.
Russia, Perm	46	5.3	3.2	1.6	1.2	0.90	0.47
» Courland . . .	40	4.1	2.9	1.9	1.3	1.02	0.71
» » . . .	31	5.1	3.2	1.8	1.4	1.06	0.75
Scotland	20	4.3	2.7	1.6	1.1	1.10	0.71
Prussia, East	18	4.3	2.9	1.85	1.3	1.06	0.79
» Brandenburg.	32	4.9	2.9	1.8	1.4	1.30	0.79
Belgium	21	5.1	3.2	1.9	1.5	1.10	0.83
Bavaria	33	4.7	3.3	1.9	1.4	1.14	0.75
France	22	4.5	2.9	1.8	1.25	0.98	0.71

Development of 7-8 year trees planted out (autumn 1914).

Country of origin	Height of trees				Diameter at base of stem				Growth classes (percentages)					
	Bispgarden (lat. 62° 59')		Hässleby (lat. 57° 38')		Bispgarden (lat. 62° 59')		Hässleby (lat. 57° 38')		I		II		III	
	max.	av.	max.	v.	max.	av.	max.	av.	Bispgarden	Hässleby	Bispgarden	Hässleby	Bispgarden	Hässleby
	in.	in.	in.	in.	in.	in.	in.	in.						
Russia, Ural . . .	—	—	78.7	28.7	—	—	2.1	0.7	—	44	—	2	—	54
» Courland .	39.7	14.5	63.0	30.7	0.9	0.3	1.8	0.55	12	25	1	1	87	74
» »	43.3	15.0	55.1	31.5	1.2	0.3	1.6	0.9	18	20	1	0	81	80
Scotland	27.5	9.5	66.9	25.1	0.6	0.2	1.9	0.6	9	18	2	4	89	78
Prussia, East . . .	43.4	13.4	70.9	31.9	1.0	0.3	2.2	0.8	4	14	1	1	95	85
» Brandenburg	37.8	15.0	51.2	26.0	0.7	0.2	1.6	0.7	1	18	0	2	99	80
Belgium	31.5	13.8	66.1	13.4	0.6	0.2	1.4	0.9	0	9	1	3	99	88
Bavaria	27.5	14.2	72.0	26.0	0.5	0.2	2.2	0.8	2	0	0	6	98	94
France	22.8	7.5	51.2	20.5	0.5	0.15	1.8	0,6	2	4	0	3	98	93
Sweden, Norbotten	—	—	63.0	25.6	—	—	1.6	0.6	—	8	—	1	—	91
Hungary, Szepes .	—	—	51.2	27.5	—	—	1.3	0.55	—	4	—	1	—	95
» Pressburg	—	—	38.6	19.7	—	—	0.7	0.5	—	0	—	0	—	100
Bulgaria	—	—	50.3	17.7	—	—	1.4	0.55	—	10	—	0	—	90

It should be mentioned that the plantations at Bispgården and Hässleby were attacked respectively by *Lophodermium pinastri* and *Phacidium infestans*.

The difference in latitude, and consequently the differing climatic conditions, of the two plantations, had a considerable influence; in fact, the inferior development at Bispgården in comparison with the luxuriant growth at Hässleby is marked, in spite of seeds from Norrland being used in both cases. In both plots the Courland pines had grown better and with straighter stems; this shows that the celebrated Riga race has a very great power of adaptation to Swedish conditions. Nevertheless, it should be noted that the pines not of Scandinavian origin are by nature more or less ill adapted to the climate of Sweden.

719 – **Seed Production of Western White Pine.** — ZON, RAPHAEL (Chief of Forest Investigations), in *Bulletin of the U. S. Department of Agriculture*, No. 210, 15 pp. Washington, April 17, 1915.

In measuring the seed crop of forest trees, three things must be determined: 1) the seed production for the stand per unit of area (not for individual trees); 2) the quantity of seed and 3) the viability of the seed. The weight of germinable seed per unit of area must be accepted as the standard for measuring seed crops. If a is the weight of clean air-dried seed obtained from one acre, and p is their germination per cent, then the seed crop may be expressed by the formula $x = ap$.

The best method of studying seed production is by means of sample areas of from one-quarter to half an acre in extent in accordance with the density of the stand. Each sample area, however, should include at least 100 trees of the principal species composing the stand.

Considering light as a necessary condition for seed production, this varies in accordance with the crown development of individual trees. The sample plot must therefore include representatives of all groups of trees, *viz:* I. dominant, II. co-dominant, III. intermediate, IV. oppressed and V. suppressed.

This method of investigation was applied to the study of the seed-bearing characters of the western white pine (*Pinus monticola* Dougl.) in Idaho, in the Kaniksu and Coeur d'Alene National Forests, with the following results :

In 1911, which was a fairly good year for the production of seed, 98.8 per cent of all the seed was produced by the first two classes (dominant and co-dominant) while the third contributed only 1.2 per cent. The classes IV and V did not bear any seed at all.

Thus if in a plot the percentage of seeds produced by each class be divided by the average percentage of such trees in that plot, the ratios in which the different classes bear seed are roughly obtained.

The ratio of productivity of trees of different classes in round figures was 3·5, 1·5, 0·05, 0·0. Thus a tree of class I bore 70 times and a tree of class II 30 times more seed than a tree of class III.

The participation of the different classes in the production of seed may serve as an index of the seed crop. In exceptionally good seed years even the oppressed trees have occasional cones, while in poor seed years cones are to be found only in the dominant class and even then not on all trees or on all parts of their crowns. The abundance of the seed crop can, therefore, be prognosticated very early in the summer by observing, in the forest, the kind of trees that bear cones.

The development of the crown seems to be the most important factor governing the quantity of germinable seeds, as the largest amount was invariably produced by trees chiefly of the first and second classes.

The age of trees evidently has an effect upon the amount and quality of seed produced. Thus the younger trees, ranging from 72 to a little over 100 years in age, produced practically in all three classes a larger quantity of germinable seed than the older trees. Apparently age has also something to do with the average length of the cones, since the younger trees possessed, on an average, longer cones yielding a larger number of pure seeds per cone than the older trees. The germination percentage was also greater in the younger trees than in the old ones; the highest reached (90 per cent) was found in a tree 72 years old.

The relation between the length of the cone and the size of the seed (the number of seeds per pound) is clearly shown. Thus the largest cones, 8 inches and over, yielded 22 000 seeds to the pound, while cones 5 inches long occasionally yielded as many as 57 000 seeds to the pound.

The vigour of growth apparently influences favourably the amount and quality of seed produced.

While a relation between the size of the seed and its germinative vigour (determined by the percentage of seed which germinated within 144 days after being sown) is not clearly brought out, yet there seems to be a tendency for the larger seeds to have the higher germinative vigour. This was highest (42 per cent) with the seeds numbering 25 000 to the pound and lowest (13·4 per cent) with seeds numbering 32 000 to the pound.

The size of the seeds and the germination percentage are closely connected, as are also the lengths of the cone and the quality of the seed. *The larger or heavier the cones the larger is the seed, and the larger the seed the greater is the germination percentage: therefore the larger the cones the better is the quality of the seed.*

The largest yield by an individual white pine tree was 2 ½ ounces, or 6 000 germinable seeds. Normally stocked stands bear from 2 ½ to 5 pounds of germinable seed per acre. A yield of 3 pounds, or 90 000 germinable seeds, per acre, for a moderately good seed year, may be accepted as the average seed crop for the white pine in the Kaniksu and Coeur d'Alene National Forests.

720 – **The Length of Wood Fibres in relation to the Resistance and the Uses of the Wood.** — GERRY, E., in *Science*, Vol. XLI, No. 1043, p. 179. Lancaster, Pa., 1915.

As the result of the determination of the length of 100 fibres in each of 66 specimens of *Pinus strobus*, it was found that the length varies according to the situation in the plant. In a disc taken from a trunk 250 years old at about 24 inches from the base and also in ano ther taken at a height of about 80 feet, the shortest fibres were found near the pith. It appears that the length increases towards the periphery, but in an irregular manner. No constant fibre length was attained.

In 26 samples (bolts) taken at about 2 ½ to 3 inches from the pith, at 4-foot intervals between the butt and the top of the tree, a tendency towards an increase in average length of fibre was apparent for about two thirds of the height of the tree.

The relation between the fibre length and the strength values was indeterminate: no direct effect dependent on length alone can be found. The following indications however were obtained: 1) from butt to top the specific gravity and strength decreased, but average fibre length increased; 2) in some loblolly pine (*Pinus taeda* L.) the late wood was about twice as strong as the early wood, the relative fibre length being as 2.69 is to 3.03 mm.; 3) in Rotholz the fibres are also stronger (in compression) and shorter than those in normal wood. Thus the shortest and at the same time thickest-walled fibres were present in the strongest specimens.

The general range of variation in fibre length was not found to be greater within the species than in the individual tree. From 1700 measurements of 15 specimens of longleaf pine (*Pinus palustris*) and 900 measurements of Douglas fir (*Pseudotsuga taxifolia*) it was found that the largest fibres occurred in the earliest spring wood; the length then decreased

gradually and the shortest fibres were present in the last formed layers of the ring.

The root fibres of longleaf pine and white pine were found to have a fibre length as long as or even longer than that of the trunk fibres. This may enable the pulp mill to utilise stumps obtained where land is being cleared, or the chips from which resin has been extracted, for a strong craft pulp.

In general the hardwoods or angiosperms have a shorter fibre than the softwoods or gymnosperms. All other things equal, the strength of a pulp varies with the length of the fibres composing it.

The early or spring-wood fibres are always longer than the late or summer-wood fibres. The data obtained from about 80 specimens indicated that less than one-fourth of the fibres found in every hundred macerated fibres were summer-wood. In two case the summer-wood fibres made up about one-third of this amount; in both cases this large number of fibres was found in wood from very low down in the tree. The percentage and character of the summer-wood fibres are significant factors in determining the character of a wood to be used for pulp.

721 – **Ligneous Mass and Shape in Spruces with Different Types of Branching.** — Sylvén, N., in *Meddelanden från Statens Skogsförösksanstalt*, Part 11, pp. 9-60, figs. 20. Stockholm, 1915.

In preceding researches on spruce (*Picea excelsa*), the writer had established the existence of five types defined by the appearance of their secondary and upper branches, *viz.* type *a*) pure pectinate, *b*) irregular pectinate, *c*) ligulate, *d*) laminate, *e*) brush-like, in addition to all the intermediate forms (1). For his present researches, the writer has had more abundant material at his disposal and he has undertaken the study of the sylvicultural qualities of these types of spruce.

It would appear in the first place that spruces of the pectinate type consist of forms uniting good forestry properties with certain botanical characters. In fact by means of their pectinate and pendent secondary branches, they expose their needles to the light in the most advantageous manner, while the reciprocal shade cast by the various branches is relatively slight; this tends to favour their development. The trees with brush-like branching come next in order, as regards the favourable exposure of their assimilating organs; these are followed, at a certain distance, by the ligulate and laminate forms, which, owing to the thicker shade among their branches and the unilateral exposure of their needles in the upper part, presumably possess weaker assimilatory activity.

The chief results of the measurements taken are summarised in the accompanying table, which is based on data referring to a varying number of trees (less than a thousand) in the stands of Central Sweden (Malingsbo and Grönsinka) and Southern Sweden (Sundsmarken).

The superiority of the pectinate type is evident and exceeds the limits of error; it is also confirmed that these trees form an early type, resistant to

(1) See *B.* Jan. 1911, No. 168. (*Ed.*).

Masurements of the Different Types of Spruce.

Locality and age of stands (years)	Pectinate Type				Brush Type				Ligulate and Laminate Types			
	Average diameter	Average height	Average coefficient of shape	Average ligneous mass.	Average diameter	Average height	Average coefficient of shape	Average ligneous mass.	Average diameter	Average height	Average coefficient of shape	Average ligneous mass.
	in.	ft. in.		cu. ft.	in.	ft. in.		cu. ft.	in.	ft. in.		cu. ft.
Malingsbo :												
100	12.7	76 9	0.691	34.0	11.4	75 2	0.692	26.1	10.4	66 11	0.684	20.0
70	11.5	72 10	0.658	25.1	11.0	70 3	0.660	22.3	10.9	70 6	0.656	21.6
100	12.2	78 5	0.663	30.3	11.7	76 2	0.670	27.4	10.1	75 6	0.670	20.5
100	11.8	79 5	0.671	29.1	10.3	73 10	0.665	20.6	10.8	74 6	0.663	22.6
45	9.1	66 0	0.662	14.5	7.5	59 5	0.658	8.8	6.5	55 6	0.658	6.6
100	13.0	84 4	0.673	37.4	11.6	79 5	0.670	28.3	11.7	80 9	0.673	29.1
120	10.4	77 1	0.680	22.7	9.6	73 6	0.683	18.5	9.5	71 2	0.673	17.2
90	9.0	65 7	0.661	14.3	8.1	63 0	0.663	11.0	7.6	58 9	0.667	9.2
90	8.9	68 7	0.668	14.5	7.4	61 8	0.675	9.4	6.8	56 9	0.679	7.2
Sundsmarken :												
60	13.7	77 9	0.692	40.3	12.7	74 10	0.687	32.7	11.6	70 10	0.678	26.1
Grönsinka :												
60	6.9	54 5	0.679	7.2	6.3	50 6	0.670	5.6	6.5	49 3	0.655	5.4
90	9.5	55 5	0.665	13.3	8.2	50 2	0.635	8.8	7.8	48 7	0.656	7.8
90	8.9	58 5	0.661	12.4	8.0	53 10	0.663	9.3	7.5	48 11	0.654	7.5

rot, and that pectinate branching is hereditary. The writer has also determined that in zones of heavy snowfall, pectinate spruces are abundant, as has also been observed in the Alps, for instance in the Engadine; this shows the special resistance of the type to the weight of snow, which would be a factor of natural selection. The writer therefore concludes that everything possible should be done to promote the spread of pectinate spruces in the forests of Sweden, care being taken to select cones for seed from trees of this type; this would certainly tend to increase the yield of the Swedish forests; the same applies in general to stations where heavy snowfalls are destructive to stands of spruce.

722 – **Method of Preserving Acorns for Sowing.** — ONLIEFF, A. (Inspector of Forests), in *Liesnoi Journal* (Forestry Review), Year XLV, Part 1-2, pp. 255-259. Petrograd, 1915.

A method of keeping acorns for seed adopted in the Forestry Domain of the Province of Kasan since 1906 appears to be the best hitherto tried, probably because it approaches most nearly to the natural system. The ground chosen for storing seed acorns is a small clearing of about half an acre, on a north slope surrounded by dense, old broad-leaved trees, so as to be well sheltered from the winds, which in this region are very strong, especially in spring. The spot selected is thoroughly cleaned of all acorns and forest litter (in order that the mice cannot make their nests in it); round it is dug a ditch one foot deep and wide, with inclined sides and embankments on the outer side; to this is connected another ditch excavated the whole length of the slope of the clearing to carry off the water. This protecting ditch is absolutely necessary to prevent, or at least hinder, the invasion of mice, which are very numerous in the place where the method is applied. After the ground has thus been prepared, it is covered with a layer of dry leaves (preferably oak) about an inch deep; upon this is placed a layer of selected, dry acorns about 2 ½ inches thick; these are then covered with more leaves and branches to protect them from wind. When the winter has set in for good and the snow no longer melts, if it has not fallen in sufficient quantities, it is piled up to a depth of 2 ft. on the place where the acorns are buried; then a layer of straw of 7 to 10 inches thick is spread over the snow and the acorns are left until the spring. From ten days to a fortnight before the time of sowing the acorns are uncovered and left either in the clearing or on the place where they are to be sown till they begin to germinate. It is best to make several of these deposits of acorns upon the same area and to uncover them one after the other as required.

This method is the most satisfactory, in the writer's opinion, because it does not entail all the precautions necessary for preventing the acorns heating and rotting and for protecting them from frost; further, by the aid of this system, the largest percentage of well preserved acorns fit for sowing is obtained with the smallest outlay.

723 - **The Utilisation of Ferns in Carniola.** — E. F., in *Centralblatt für das gesamte Forstwesen*, Year XL, Part 9-10, pp. 408-410, 1 fig. Vienna, 1914.

The common bracken (*Pteris aquilina*) is very plentiful in Carniola, where it often dominates sunny slopes and is gathered in the autumn for litter. In damp places, ferns of the genera *Aspidium* and *Nephrodium* are very common, especially the male fern, from the roots of which filicine is prepared; these plants are, however, only collected to a limited extent. The gathering of another fern has developed into a real industry, greatly to the advantage of the owners of the wood, the gatherers and the trade. This fern (*Aspidium aculeatum* Sw., in its subspecies *lobatum* Sw. with 8 forms and *angulare* W. with numerous variations) is gathered in large quantities for decoration. Permission to cut it is given by the owners on payment of a farthing or more per acre. The ferns are collected by men, women and children from the end of October to April according to the season; fronds are cut just above the roots and tied up in packets of 50; a thousand perfect fronds fetch 10*d* or even 1*s* 1*d* in dry years; and one person can pick three or four thousand in a day. The agents, of whom there is a special society at Upper Laybach, store the ferns in cellars and despatch them to order, packed damp in cardboard boxes, to all parts of the world; the chief centres of consumption are Berlin, Paris, London, Constantinople and New York. Several million boxes are sent annually at the rate (without postage or packing expenses) of 1*s* 9*d* to 2*s* 2*d* per thousand, or 1*s* 7*d* per lb.

LIVE STOCK AND BREEDING.

724 - **The Physiopathology of Fatigue in Animals in Connection with Diminished Resistance to Infectious Disease.** — DALÒ, FERRUCCIO (Institute of Comparative Pathology of the Royal Veterinary College of Milan) in *Il Moderno Zooiatro*, Series V, Year IV, No. 4, pp. 165-174. Bologna, April 30, 1915. HYGIENE

The results obtained by many experimenters, which the writer briefly reviews, allow fatigue to be considered as a real form of self-poisoning, which naturally diminishes considerably the natural means of defence of the organism against various diseases. That fatigue favours the development of diseases due to micro-organisms has been directly demonstrated by CHARRIN and ROGER. It is well known that perfectly healthy subjects are often the habitual hosts of pathogenic germs, and that if the resistance of the organism diminishes through any internal or external cause, the pathogenic power of the germs increases and proves superior to the means of defence possessed by the organism.

Professor GUERRINI, Director of the Institute of Comparative Pathology of the Royal Veterinary College of Milan, has demonstrated that in the blood-serum of tired animals substances (chenotoxins) are present which cause the inhibition of the phagocytal properties of leucocytes, and has arrived at the following conclusions: 1) Leucocytes that have been kept in contact with the serum of tired animals show a considerable fall in the phagocytal index,

namely from 15.2 to 4.4. 2) This sinking of the phagocytal index is a function of the degree of fatigue of the animal, and varies directly with it. 3) The fact must be due to an action caused by the serum of the animals, because it was observed also when the leucocytes extracted from tired muscles were well washed in physiological solutions.

As there is no doubt that the phagocytal action of leucocytes is one of the most efficient means which an organism possesses as a defence against the spread of pathogenic germs, and considering that a fatigued organism is really much weakened in almost all its organs, which become the seat of self-poisoning, and that the leucocytes of such an organism show only a very limited action against bacteria, there are sufficient grounds to warrant the conclusion that fatigue is one of the chief predisposing causes of infectious diseases.

725 – **Researches into the Presence of the Antibodies of *Bacillus abortus infectiosi* in the Blood and Milk of Milch Cows suffering from Abortion.** — REINHARDT, R., and GAUSS, K., in *Zeitschrift für Infektionskrankheiten*, Vol. XVI, Part 4, pp. 219-238. Berlin, 1915.

After BANG and STRIBOLT had demonstrated that contagious abortion in cattle is caused by a specific organism, it was endeavoured to ascertain : 1) whether in the blood of cows suffering from abortion specific anti-bodies are formed as is the case in other infectious diseases (1) ; 2) whether the serological methods (notably the agglutination and complement-fixing reactions) (1) can be used in the diagnosis of suspected animals ; 3) whether the above-mentioned methods are capable of furnishing positive results of practical value.

The writers give a summary of the experiments carried out by HOLTH, GRINSTEDT, SVEN WALL, HADLEY, BEACH, ZWICK, ZELLER and others as to the utility of the two methods. All these investigators are unanimous in asserting that the agglutination and complement-fixing reactions brought about by the action of blood serum are undoubtedly capable of demonstrating infection by *Bacillus abortus infectiosi*.

The question then arises as to whether there are present in the milk of cows suffering from abortion any specific anti-bodies whose existence can be demonstrated. This question is not merely of scientific interest, for if by a simple analysis of the milk, which is easily obtained, it were possible to determine the presence or absence of agglutinines, or substances capable of fixing complements, it would be easy to ascertain the existence or otherwise in the herd of the organism causing abortion. Since the experiments made on this subject (MC FADYEAN, STOCKMAN, SVEN WALL) had not yet furnished any practical results, the writers proposed to continue the investigations. The experiments referred to the milk of two artificially infected goats, and also to that of cows which had spontaneously contracted the disease and had aborted ; the object of these experiments was to ascertain : 1) whether the milk of animals suffering from abortion contains

(1) See below No. 745, with accompanying note. (*Ed.*)

agglutinines and complement-fixing substances capable of detection; 2) whether the examination of milk is of use in the diagnosis of contagious abortion ; 3) the proportion of immunising substances in blood and milk ; 4) how soon after infection products of the reaction appear in the milk ; 5) when they attain their maximum importance and how long they are present in the milk.

From the total results obtained the writers draw the following important conclusions :

In the case of animals suffering from abortion, specific anti-bodies pass regularly into the milk and remain there for a considerable period. Their presence can be detected in the milk serum by means of agglutination and complement-fixing methods.

In order to obtain the milk serum the milk should be coagulated with rennet in a water-bath at 45° C. The anti-bodies are found in smaller quantities in milk serum than in blood serum.

The agglutination standard in the milk of animals infected with the organism of abortion varies between 1 :20 and 1 : 1000, the average being 1 :100 to 1 :500. The complement-fixing reaction may be considered as positive when it is induced by the addition of 0.2 cc. of serum or even less.

In the case of milk serum from healthy animals, no agglutination or complement-fixing takes place.

Milk serum is very well adapted for revealing the presence of contagious abortion by means of the agglutination and complement-fixing reactions.

For practical work the use of milk is preferable to that of blood, being easier to procure ; further, the fact that many owners object to their animals being bled is the source of a certain amount of difficulty.

For the examination of the milk serum and similarly with the blood serum, the combined use of agglutination and complement-fixing is to be recommended. If, with the assistance of these two methods combined, the milk serums of several animals of a herd are examined simultaneously, especially the serums of those that have aborted a short time before the analysis, the diagnosis can be made with as much certainty as in the case of examination of the blood.

The article is followed by a Bibliography including 25 works.

726 - **Swine Tubercolosis and the Possibility of its Practical Control.** — I. Bang, O. Bacteriological Researches Respecting Swine Tuberculosis. — II. Holm, E. The Control of Swine Tubercolosis, in *88de Beretning fra Forsøgslaboratoriet* (88th Report of the Research Laboratory of the Royal Veterinary College of Copenhagen), pp. 5-28 and 29-63. Copenhagen, 1915. — *Communicated to the International Institute of Agriculture by the Danish Correspondent, Baron* Rosenkrantz.

I. — The object of the researches in question was to determine whether, under normal conditions, mammals can be infected by fowl tuberculosis, and conversely fowls by the bacilli of the mammalian form of the disease. The latter half of the question, in so far as infection by foodstuffs is concerned, can be answered in the negative. The case, however, is quite different where the food of large mammals contains the bacilli of avian tuberculosis. The writer has made various researches on this subject, and

with the veterinary surgeon RASMUSSEN of Faaborg, was the first investigator in Denmark to draw attention to the frequent connection between swine and avian tuberculosis on the same farm.

The conclusions derived from his experiments were as follows :

1. The bacillus of mammalian tuberculosis is the principal cause of swine tuberculosis, especially in the severest forms of the disease, which are due, in the majority of cases, to infection by cattle.

2. Local glandular tuberculosis is very frequently caused by the bacilli of avian tuberculosis. In July 1913, a slaughterhouse in South Seeland sent in bacteriological preparations from all the pigs signified as tuberculous by the authorities during the month. Inoculation experiments by means of these preparations gave the following results :

In all the 18 cases of mesenteric tuberculosis the bacilli of avian tuberculosis were present.

Out of 24 cases of local tuberculosis of the neck, the bacilli of avian tuberculosis were found in 19, those of the mammalian form of the disease in 4, while in one case the inoculation gave a negative result.

In all the 22 cases of general glandular and organic tuberculosis the presence of the bacilli of mammalian tuberculosis was recorded.

Thus in more than half the cases examined disease was due to the bacilli of avian tuberculosis.

Local glandular tuberculosis was produced, in 90 per cent of the cases, by the bacilli of avian tuberculosis, while on the other hand organic tuberculosis was due to the bacilli of mammalian tuberculosis.

Other experiments, of which the report gives a summary, confirm these conclusions.

The experiments have further established that local glandular tuberculosis in pigs may be due, in certain cases, to the contagion of tuberculous human beings.

The report in question gives in detail the results of tuberculin injection experiments on pigs. The injection at the base of the ear was effected in these experiments by the intracutaneous method ; that is to say, a small quantity of tuberculin was injected into the skin itself. In the case of tuberculous pigs a large swelling makes its appearance at the place of injection in the course of 24 hours and the reaction attains its maximum 48 hours after the operation. A large number of injections were made and each reaction was at once controlled by killing the animal and examining it, thus enabling the value of the tuberculin test to be checked. It was found as a result of these experiments that a positive reaction to tuberculin practically always means that the animal is infected when it is a question of bovine tuberculosis, but the reaction gives no indication of the extent of the disease. These results were obtained with tuberculin prepared from the bacilli of mammalian tuberculosis. Avian tuberculin, as far as the disease caused by the bacilli of avian tuberculosis is concerned, possesses a diagnostic value which is at least equal, and sometimes even superior, to that of bovine tuberculin.

II. — According to the statistics of the large Danish slaughterhouses, 4.7 per cent of the total number of pigs slaughtered were tuberculous ; this caused a decrease in the receipts amounting to 1 or 2 million crowns (£ 50 000 to £ 100 000), the importation of the meat of tuberculous animals into Eng-

land being forbidden by law. All the cooperative slaughterhouses, which pay for the animals according to their value on slaughtering, give less for tuberculous pigs (the price varying in the different establishments), but this reduction, especially in the case of animals which are totally condemned, does not cover the loss. By still further reducing the prices they pay, the slaughterhouses could do much to assist the control of swine tuberculosis.

As a result of some correspondence with the Director of the Jutland slaughterhouse on the subject of the control of this disease, the Research Laboratory of the Royal Veterinary College organised several series of practical experiments with a view to combating swine tuberculosis in West Jutland, where it is very common. About twenty farms were selected as having supplied a particularly large number of tuberculous pigs, and on these farms measures for the prevention of tuberculosis in pigs were carried out according to instructions supplied by the Laboratory. The pigs used for the purpose were marked and first subjected to the tuberculin test to ascertain their freedom from infection. Each sty was cleaned and disinfected and it was forbidden to give the pigs any unboiled milk (1), or the remains of the cows' food, nor were the pigs allowed to run about in the cow-houses. Care was taken to keep all fowls and pigeons away from the pig-sty and the men were forbidden to spit. In many of the farms of this region, the pig-sties are built in the cow-houses and situated just behind the cows, so that the excrements and urine of the latter animals often fall into the pigs' troughs. The danger of infection in these cases is very great, for it is possible that one or more of the cows may be suffering from tuberculosis of the udder, lungs, or uterus. In these experiments the pig troughs were provided with covers.

As the principal result of these measures it has been recorded that 40 per cent of the farms are completely freed from tuberculosis, while the percentage of tuberculous pigs in the remainder has greatly decreased. The results would have been still more conclusive had all the experimental animals been reared on the spot.

In Fünen, many experiments were made for the purpose of preventing the transference of tuberculosis in poultry to pigs. Seven farms were selected where the tuberculin test had proved the cattle to be healthy and the pigs to be infected with tuberculosis. The latter animals had been bred on the premises. The pig-sties were protected from the poultry by enclosing them with high wire-netting and fixing automatic closing apparatus to the doors. The result of these precautions has been excellent, the percentage of tuberculous pigs having fallen from 28 (the figure for the preceding year) to 2 per cent, while three out of the seven farms are, at the present time, entirely free from the disease.

(1) It is whole milk which is here meant. It is illegal in Denmark to give either skim milk or buttermilk to live stock unless it has been previously heated to at least 80° C.

FEEDS AND FEEDING

727 – **The Chemical Composition of Some Weeds and their Value as Fodder and Manure.** — KLING, M. (Speyer Agr. Expt. Station), in *Die landwirtschaftlichen Versuchs-Stationen*, Vol LXXXV, Part VI, pp. 433-469. Berlin, 1914.

The writer has analysed some of the commonest weeds growing in the vineyards in the Palatinate: bindweed (*Convolvulus arvensis* L.), goosefoot (*Chenopodium*), chickweed (*Stellaria media* Cyrillo), field thistle (*Cirsium arvense* Scop.), sowthistle (*Sonchus oleraceus* L.), and *Mercurialis annua* L.; these are fed by preference to cows, in addition to other weeds and chopped vine shoots.

After reference to the few existing analytical data the writer gives the results of his analyses *in extenso*. The first point these bring out is that the species analysed remove large quantities of fertilising substances from the soil. Thus, analysis of their dry matter gave from 2.77 to 4.45 per cent of nitrogen, 0.85 to 2.01 phosphoric acid, 4.91 to 11.78 potash and 1.03 to 5.30 lime. Care should be taken therefore that these fertilising substances are not removed from the soil; on the contrary they should be placed at the disposal of the cultivated plants by digging in the weeds as soon as they appear.

When, however, it is impossible to prevent the growth of weeds, those that are suitable can be used as fodder; for this purpose the plants must not be cut very near the soil as otherwise too much earth is introduced and they require washing before being fed to cattle.

With the exception of *Mercurialis annua*, the weeds analysed make very good green fodder, especially for milch cows. Bindweed has the highest nutritive value, with dry matter 16.90 per cent; the following is the composition of the dry plant freed from soil: crude protein 22.60 per cent, albumen 13.64, fats 3.48, N-free extract 42.35, crude fibre 19.68, phosphoric acid 0.94, potash 1.87 per cent.

In the green state the above-mentioned weeds are far from possessing the nutritive value of clover or lucerne, but in the dry state they are undoubtedly superior to these.

Mercurialis annua, in spite of its high nutritive value, is not suitable for feeding purposes, and can only be used for green manure. As has been seen above, all the species examined are rich in nitrogen and potash; chickweed and goosefoot especially have a considerable percentage of potash (10.9 per cent); thus the manurial value of these weeds is by no means negligible.

The article is followed by an appendix with 15 bibliographical references.

728 – ***Zygadenus* or Death Camas.** — MARSH, C. D., CLAWSON, A. B., and MARSH, H. — *Bulletin of the U. S. Department of Agriculture*, No. 125, 46 pp. Washington, D. C., May 13, 1915.

Various species of *Zygadenus* grow abundantly on the stock ranges of the western United States and have long been suspected of being poisonous and of causing serious losses to sheep breeders. Experiments were carried out during five seasons in Colorado and Montana for the purpose of ascertaining the effect of the various species on sheep, cattle and horses.

In the greater part of the experiments, *Z. venenosus* was used, but

comparative trials with *Z. elegans* and *Z. paniculatus* showed that the two latter plants were of equal toxicity, while on the other hand *Z. coloradensis* had to be fed in very large quantities in order to cause symptoms of poisoning to appear. The plants prove poisonous throughout their entire period of growth and develop a maximum of toxicity at the time of flowering. Their seeds subsequently become by far the most poisonous part of the plant. In spite of the greater toxicity of mature plants, cases of poisoning on the open range would be more likely to occur during the earlier period of growth, because at that time other forage is scantiest.

The dose required to produce serious toxic symptoms varied considerably with individual animals and with the manner in which it was administered. When fed mixed with the daily ration, up to 5 lbs. of the green plant per 100 lbs. live-weight was taken without ill effects. But in the majority of cases the animals showed a marked aversion to consuming the plant with their other food and it then had to be administered in the form of a drench or a ball ; in such case the toxic dose was reduced to about one tenth of the above quantity.

The principal symptoms of poisoning were salivation and nausea, followed by muscular weakness and coma. No satisfactory antidote was discovered, but the sick animals were kept quiet and usually recovered, death only occurring in about 15 per cent of the cases and then only with sheep, which formed by far the most numerous subjects of the experiments.

729 - **Some Experiments on the Mendelian Laws of Heredity.** — PUCCI, CARLO (Director of the Zootechnical Laboratory of the Royal Agricultural Institute of Perugia), in *Il Moderno Zooiatro*, Series V, Year IV, No. 4, pp. 145-153, 6 figs. Bologna, April 30, 1915. BREEDING

I. — *Inheritance of coat colour in rabbits.* — The writer mated some grey Flemish giant rabbits with : 1) white pink-eyed Polish rabbits, and 2) spotted Dutch rabbits.

1. Before beginning these crosses between the Flemish and Polish rabbits he assured himself, by repeated breeding during several seasons, of the fixity of the characters considered. In F_1 the grey colour of the Flemish parent was dominant to the white of the Polish, but almost all the rabbits showed whitish spots. The F_2 generation consisted of 58 individuals, of which 52 were pigmented (38 grey and 14 black or blue) and 16 white. The pigmented coats were as follows :

7	grey, self coloured.
18	grey, spotted.
13	spotted yellowish grey.
2	black, self coloured.
2	blue, self coloured.
10	spotted blue.

Thus, besides the intense and dilute grey, black and blue appeared, the latter being a dilute black. Grey proved, as it generally does, dominant to black, while contrary to what should be expected from the observations of HURST, CASTLE, etc., the spotted type appeared dominant to the self coloured. The number of white rabbits compared with that of the pig-

mented ones follows the Mendelian ratios. From the results hitherto obtained it appears that the self coloured individuals of the F_2 generation behave as heterozygotes and the white as homozygotes.

2. From the cross between Flemish and Dutch rabbits, in the F_1 generation there resulted some only partially coloured individuals. All of these heterozygotes showed white spots round their necks, as had already been observed by HURST, and the great majority also showed spots similar in extent and size to those of the Dutch breed.

II. — *The convex profile of the face in Perugia sheep.* — At the Casalina estate (near Perugia) progressive crossing is carried out between Rambouillet Merino rams and Middle Tiber Valley ewes, the latter being allied to the Val di Chiana sheep. One of its most marked characters is the very convex profile of nose and forehead (while in the Rambouillet Merino it is quite straight) ; its fleece is open and the head, throat, belly and limbs are devoid of wool. The results obtained lead the writer to conclude :

1. In F_1 all the crosses have a straight face profile.

2. In F_2 the convex profile appears in a ratio very nearly following Mendel's law.

3. The extent of the fleece is greater in individuals with a straight profile and seems to follow, like this latter character itself, the laws of dominance and of the numerical constancy of reversion.

PIGS

730 – **Comparative Fattening Experiments with Pigs in Denmark** (1). — LUND, A. V. Reprint from : *87de Beretning fra den Kgl. Veterinaer- og Landbohøjskoles Laboratium for landøkonomiske Forsøg* (87th Report of the Laboratory for Agricultural Research, Royal Veterinary and Agricultural College, Copenhagen). — *Communicated by the Correspondent in Denmark, Baron* ROSENKRANTZ.

At three Experiment Stations situated in different districts of Denmark there were carried out from September 1, 1913, to September 1, 1914, fattening experiments with 63 to 93 lots of pigs, each lot containing 4 animals. The latter were fed exclusively on cereals and skim milk ; both feeding and slaughtering were carried out under the supervision of the Research Laboratory of the Royal Veterinary College. The pigs, which were sent to the Experiment Stations at 6 to 8 weeks old, all came from farms where either the native Danish breed or Yorkshires were raised. These farms were scattered throughout the country and were selected by the Commission on Pig-breeding (" Svineavlens Ledelse ") as being especially suited to supply pure-bred animals. The owners of the breeding establishments in question receive an annual grant from the State on condition that their premises are subject to official control, and that they sell breeding animals at special prices. They further undertake to supply the Station in their district, at ordinary market prices, with a certain number of pigs for experimental purposes ; such animals must have been bred on that particular farm, be all of the same litter and the offspring of parents that are regarded as the best of the herd.

(1) For the 85th Report of the Royal Veterinary College of Copenhagen on this subject see *B.* Nov. 1914, No. 1032. (*Ed.*)

In this way, the Breeding Commission is kept constantly informed, by means of the fattening and killing data obtained at the Experiment Stations, of the crossing and bacon-producing properties of the pigs belonging to each breeding establishment. In these experiments attention is not only paid to the meat yield, but naturally also to other qualities, such as constitution and fertility and the milk production of the sows ; by judicious consideration of all these factors, it is then possible to form a judgment as to the merits of each herd.

As has been already mentioned, there are in Denmark establishments which breed both the native race and Yorkshires (Large Whites), but the former are much the more numerous. The data included in the 87th report, of which the following table gives a summary, show that the Yorkshires are superior to the native breed as animals for the butcher and in the percentage of meat they yield for export, while from the point of view of growth and thriftiness the two breeds seem equal.

Although Danish pigs are inferior to Yorkshires in these respects they seem to be improving greatly, and will doubtless before long, thanks to the work of the Stations, attain the desired ideal and form a race of pigs which are equally good both for breeding purposes and for the butcher.

At the present time the advantage in the market lies with the Yorkshires, while they are inferior as breeding stock, being scarcely strong enough to stand the conditions obtaining in Denmark.

Average Results of the Fattening Experiments.

Breed	Number of pigs	Average age when killed (in days)	Average weight in lbs.		Forage units necessary for ½ kg. increased weight	Per cent of meat for export	Score given * : 0-15			
			At beginning of experiment	At end of experiment			Consistency of meat	Sides	Hams	Quality
Native. . . .	648	193	30.6	201.7	3.69	60.3	12.7	11.4	11.4	12.1
Yorkshire . .	241	198	31.3	199.9	3.62	62.0	13.5	13.5	12.7	13.3

* Scale: 15 = excellent ; 12 = very good ; 9 = good, and so on.

In the report of the Bregentved Experiment Station, mention is made of the new method adopted of marking pigs (tattooing), which will eventually replace the older and less satisfactory methods of notching the animals' ears and of affixing numbered buttons. In the new system the numbers are imprinted on the ear by means of a special kind of tongs ("Markierungszange" of Hauptner, Berlin), and Indian ink is rubbed into the marks, so that as the ears grow the numbers become increasingly visible.

POULTRY

731 - **Mendelian Inheritance of Fecundity in the Domestic Fowl and Average Flock Production.** — PEARL, RAYMOND, in *The American Naturalist*, Vol. XLIX, No. 581, pp. 306-317, Lancaster, Pa., May 1915.

As a result of the investigations carried out on the inheritance of fecundity in poultry, the system of so-called mass-selection, or indiscriminate breeding from all fowls having a high egg production, has been abandoned at the Maine Experiment Station. During the last two or three seasons another system has been introduced in its place, *viz.* the organised mating of selected strains of fowls whose gametic composition has been previously determined. Though the change of method is so recent there is already a marked increase in the average egg production as compared with the numbers obtained when simple mass-selection was practised ; moreover the increase is most pronounced during the winter season, a factor to which special attention was paid in the breeding.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

732 - **Sowing and Weeding Ricefields with the Aid of Machinery.** — BRANCHINI, A. in *L'Italia Agricola*, Year 52, No. 4, pp. 155-159; 5 figs. Piacenza, April 15, 1915.

For some time past rice-growers have been endeavouring to sow rice and to control weeds in rice-fields with the help of machines (1).

Since 1903, in the province of Pavia, Italy, experiments have been made with drills, the use of which has spread to a certain extent in the province, and the problem of sowing rice may be said to be completely solved, while that of controlling weeds has not yet been so generally and successfully dealt with.

In 1909 Sig. CABRINI of Vigonzone (Pavia), starting from the principle that rice in shallow water grows rapidly and vigorously, while both rice and weeds grow slowly and feebly under a greater depth of water, constructed an implement to throw up small parallel ridges about 1 foot apart, on which the rice was sown. The crop grew vigourously while in the furrows the weeds came up badly owing to the greater depth of water.

In 1910 and 1911 the experiments were repeated and the weeds were removed by small iron hand rakes.

In 1912 one ridging implement was fitted with a rice drill to sow the ridges and another one was provided with teeth to harrow the furrows. The teeth were mounted on small converging iron bars which could be shifted at will so as to harrow a greater or less width of furrow. In that year the new system was applied to a rice field 8 ½ acres in extent. The results were satisfactory and the experiments were successfully repeated in 1913 and 1914 on larger areas and with still further improved implements. The yield was abundant and the cost of weeding considerably reduced.

The system is especially suitable for heavy and medium soils, while

(1) See *B.* Feb. 1913, No. 121 ; *B.* Aug. 1913, No. 934 ; and *B.* Sept. 1914, No. 841. (*Ed.*).

on light soils and where large quantities of rather rapidly running water are given, the ridges are apt to give way.

With a pair of oxen and an implement 10 feet wide, 8 ½ acres per day can be sown, and with one horse about 10 acres can be weeded in the same time.



CABRINI's machine for ridging and sowing ricefields.

733 - **Windmill with Vertical Shaft**. — VILLERS, R., in *La Nature*, No. 2171, pp. 310-312. Paris, May 8, 1915.

The main feature of this windmill (fig. 1) is a vertical shaft bearing a horizontal wheel or drum, the circumference of which is composed of a number of vertical slats bent in such a manner that they oblige the wheel to revolve always in the same direction irrespective of the direction of the wind, which acts both on entering and on issuing from the drum.

The slats, see fig. 2, are bent strips of sheet iron, *a*, *b*, *c*, *d*. The wind *v* on entering the drum passes between the slats and causes the drum to revolve by reaction in the direction *x*. The wind *v'* on issuing glides along the general inclination of the sail and also drives it in the same direction.

Thanks to the bent part *a*, *b* of each slat the sail utilises the difference between the thrust of the wind *v''* and that of *v'''*, so that altogether the efficiency of the windmill is very high when the inclination of the different

parts of the slats is suitably designed. As much as nine-tenths of the diameter of the drum can be utilized for useful work, and this whatever be the direction of the wind, as this mill requires no orientation.

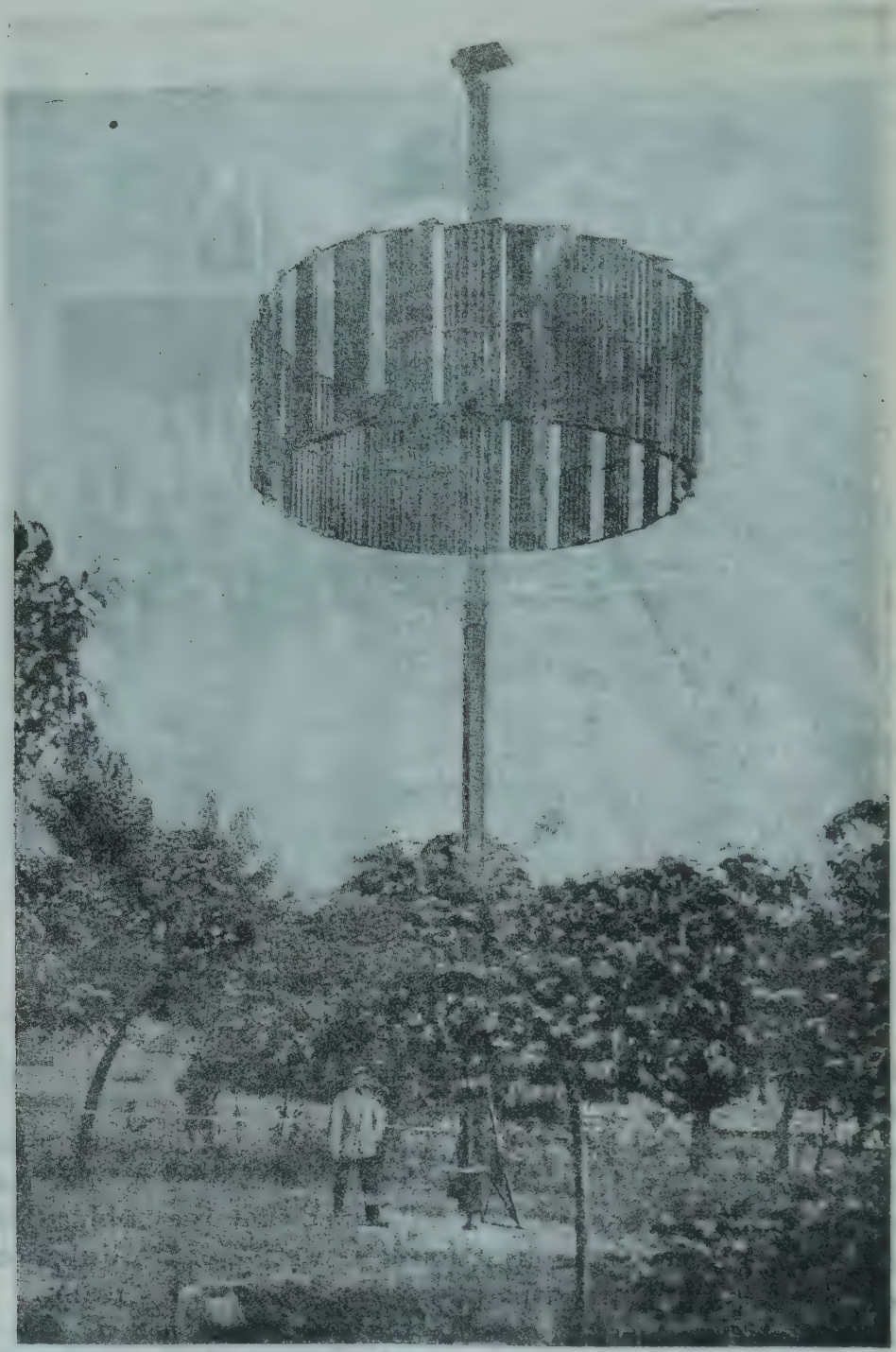


Fig. 1. — Windmill with vertical shaft.

The mechanism being very simple it is of course very cheap (about £24 everything included, or one-third of the cost of the usual windmills). It does not require any special tower or column; if there is sufficient space

he whole shaft can revolve with the drum, being held in position at the op by a pivot with guy-ring and stays.

This arrangement also has the advantage that it does not necessitate ny climbing to the top ror inspection and frequent lubrification, for the overed bearing in which the pivot works keeps the lubricant for some ears and can be fed from below by means of a pipe, and the drum is hauled p and down by ropes and pulleys.

The rotary motion of the shaft is transmitted to the pump, which can

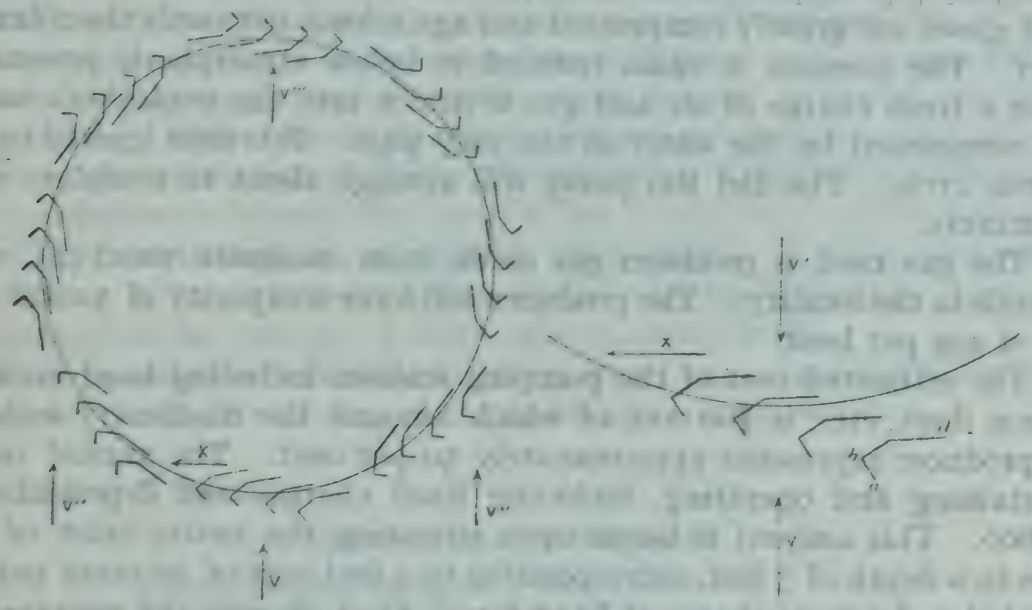


Fig. 2. — Theory of the action of the wind on the slats.

e situated at any distance from the windmill, by means of a wire rope and n excentric, which automatically adapts the stroke of the pump to the ower of the wind.

In the larger sizes the drums can be made with adjustable slats so hat the speed of the drum can be regulated at will or it can be stopped ltogether, but for the small sizes for market gardeners this is not necessary; he pump need only be thrown out of gear and the the drum can go on evolving without any danger of injury or wear.

34 - **Humphrey Gas Pumps**. — I. America's first large direct-explosion pump will irrigate Texas lands. — *Engineering Record*, Vol. 71, No. 19, pp. 596-598. New York, May 8, 1915. — II. An Egyptian pumping station. — *The Indian Textile Journal*, Vol. XXIV, No. 278, p. 378. Bombay, 1914.

I. — An installation for irrigating an estate of 6700 acres at Del Rio, exas is now partly completed. The water will be raised by a Humphrey roducer-gas pump which will deliver not less than 28 000 gallons, and erhaps 30 000 gals. per minute, to a height of 37 feet.

The pumping station is situated upon the banks of the Rio Grande. he pump cylinder and the play pipe are 66 inches in diameter. The total ngth of the play pipe is about 100 feet. In these pumps the mixture of as and air is exploded directly over the surface of the water, no piston or

moving parts being used. The increase in pressure resulting from the expl sion, all valves being closed, drives the water in the pump-head downwar and sets the whole column of water in the play pipe in motion upward as this column of water moves at a high velocity it does not stop sudden when the pressure in the explosion chamber falls below atmospheric pre sure ; when this takes place the valves open, some air and a certain amou of water enter, part of the water follows the moving column in the pipe a the rest rises in the explosion chamber. As soon as the column of wat in the play pipe stops it starts to move back, the valves shut and the air a spent gases are greatly compressed and again force outwards the column water. The pressure is again reduced to below atmospheric pressure, which a fresh charge of air and gas is drawn into the explosion chamb and compressed by the water in the play pipe. It is then ignited to sta a fresh cycle. The Del Rio pump will average about 12 complete cycl per minute.

The gas used is producer-gas made from mesquite wood (1), whi abounds in the locality. The producer will have a capacity of 50 000 cub feet of gas per hour.

The estimated cost of the pumping station, including head works, version dam, etc., is $60 000, of which amount the machinery includi the producer represents approximately 50 per cent. The annual cost maintaining and operating, including fixed charges and depreciation, $13 600. This amount is based upon irrigating the entire tract of 67 acres to a depth of 3 feet, corresponding to a fuel cost of 30 cents per ac irrigated and a gross charge of $2.06 for all fixed charges and maintenanc including fuel.

II. — Another large installation of Humphrey pumps is that in cour of construction near Alexandria in Egypt, for the draining of Lake Mareot Eighteen of these pumps, each capable of delivering 100 million gallons water per day through a lift of 20 feet, have been ordered, ten of whi will be used at first, five to be built at Glasgow and five at Milan. The cylinders will be 8 ft. 8 in. in diameter. The great economy of these pump both in first cost and in running expenses, allows them to be used whe other pumps would not pay.

735 - **Apparatus for the Utilisation of Blood and other Slaughterhouse Offal as Fo for Live Stock.** — *Wiener Landwirtschaftliche Zeitung*, Year 65, No. 38, pp. 310-3 2 figs. Vienna, May 12, 1915.

At present great quantities of valuable material, such as blood, trip trimmings, intestines and other offal, are wasted in the slaughterhouse while they could they be converted into good concentrated food for pig poultry, etc.

In order to render this offal generally available it must be prepared as to keep good for a length of time and this can be done by cooking a drying. K. NIESSEN, a civil engineer of Munich, has constructed a desi cator for the purpose.

(1) *Prosopis juliflora* and *P. pubescens*. (*Ed.*)

It consists of a boiler enclosing an agitator and surrounded by two team jackets and another, connected with a ventilator, in which air can be varmed. The agitator and ventilator are driven by power, an electro-notor being generally used.

The boiler is covered by a lid balanced by a counterweight, for con-renience in handling, which can be shut down steam-tight by thumb-crews. The boiler is filled with offal to about two-thirds of its capacity, he lid closed down and steam at about 4 atmospheres is turned on into the nner steam jacket and the agitator is set going. While the offal is thus ooking it loses water vapour, which escapes by a special pipe. When cooked o a uniform dense pap, steam is allowed to enter the second steam jacket nd warms the air in the third compartment to 65 to 70° C. (149 to 158° F.), vhence it is driven through the offal which is kept constantly stirred by he agitator. When almost all the moisture has been extracted, the agi-ator and the admission of steam are stopped and the inner jacket is fed vith condensation water; the mass is left for an hour or so to dry and is hen taken out through an opening in the bottom. The whole operation asts from 2 ½ to 4 hours according to the offal used, and the amount of team required for 100 lbs. of moist offal is about 60 lbs.

The apparatus is constructed in three sizes : 22, 44 and 66 gallons avail-ble capacity, which cost £ 93, £ 105 and £ 122 10s respectively.

36 – Review of Patents.

Tillage machines and implements.

Austria	69 152. Ditching machine.
	69 345. Harrow with series of revolving toothed rollers.
United Kingdom	1 148. Cultivator.
	1 250. Motor ploughs propelled by a spiked chain.
	1 423. Device for supporting and adjusting tool-carrying frame in power-driven cultivators.
United States	1 134 149 — 1 135 879 — 1 136 448 — 1 137 646. Ploughs.
	1 134 194 — 1 135 305 — 1 135 756 — 1 137 331 — 1 137 621. Cultivators.
	1 134 462. Shovel plough.
	1 134 548. Cultivating tool.
	1 134 639 — 1 134 654 — 1 136 043 — 1 136 661 — 1 137 560 — 1 137 644. Harrows.
	1 135 051. Alfalfa cultivator.
	1 135 091. Land packer.
	1 135 403. Adjustable coulter for ploughs.
	1 135 508. Disk harrow.
	1 135 755. Weeder.
	1 135 790. Cotton chopper.
	1 136 172. Subsoil plough.
	1 136 206. Thistle eradicator.
	1 136 525. Coulter attachment for gang ploughs.
	1 136 833. Plough beam adjustment.
	1 136 930. Cotton chopping machine.
	1 136 975. Harrow attachment for corn planters.
	1 137 031. Ploughing machine.

Manure distributors.

United Kingdom 517. Truck for transporting manure distributors.
United States 1 135 492. Fertilizer distributor.

Drills and sowing machines.

United States 1 134 891. Marker for corn planters.
1 134 894. Beet and grain drill attachment.
1 135 433. Corn planter and fertilizer distributor.

Reapers, mowers and other harvesting machines.

Austria 69 125. Hay rake on wheels.
69 127. Scythe heel.
United Kingdom 1 168. Side delivery rake and tedder.
United States 1 134 158. Cotton picking machine.
1 134 171. Side rake attachment for hay loaders.
1 134 184 — 1 134 206. Tobacco harvesters.
1 134 339. Attachment for mowing machine.
1 134 465 — 1 135 366. Grain shockers.
1 134 575. Corn harvester.
1 134 588. Cutter bar.
1 134 629. Potato-vine cutter.
1 134 928. Machine for gathering and bunching hay and grain.
1 135 096. Cotton harvester.
1 135 369. Hay stacker.
1 135 463. Attachment for mowers.
1 135 715. Sheaf shocker.
1 135 831. Grain rake.
1 136 151 — 1 136 798. Harvesters.
1 136 264. Shock loader.
1 136 403. Folding grain-harvester reel.
1 136 565. Hay rake attachment.
1 136 624. Corn harvester and husker.
1 137 594. Peanut harvester.
1 137 630. Mower and tedder.
1 137 667. Corn cutting machine.

Machines for lifting root crops.

Austria 69 121. Beet topping machine.
Denmark 20 136. Root lifting machine.
United Kingdom 1 165. Potato digger.
United States 1 134 205 — 1 135 180 — 1 136 461. Potato diggers.
1 134 221. Beet harvester.
1 135 173 — 1 135 988. Beet toppers.

Threshing and winnowing machines.

Austria 69 100. Cereal husking machine.
United States 1 136 966. Band cutter and feeder.

Machines and implements for the preparation and storage of grain, fodder, etc.

Cuba 2 226. Improvement in presses.
Denmark 20 137. Straw baler.

United States 1 134 245. Combined corn busker and stripper.
1 134 449. Corn husking machine.
1 135 249. Hay sling.
1 135 395. Potato sorter.
1 136 584. Double-belt potato sorter.
1 136 650. Gearing for ensilage machines.
1 137 059. Baling press.
1 137 334. Ensilage cutter.
1 137 611. Silo.

Dairying machines and implements.

Denmark 20 120. Apparatus for cooling freshly-drawn milk.
United Kingdom. 180. Cow milker.
1 629. Churn.
1 898. Milking machine.

Other agricultural machines and implements.

Cuba 2 225. Conveyor for sugarcane.
Netherlands 627. Apparatus for the industrial separation of lint from plant stalks, especially of ramie.
631. Machine for cutting French beans and the like.
United Kingdom. 87 — 1 329. Sack holders.
1 184. Fence posts, droppers and struts.
1 189 — 1 190. Sugarcane mills.
1 839. Machine for cracking or crushing nuts and the like.
1 873. Machine for decorticating nuts, fruit and seeds.
1 908. Apparatus for removing dust from heckling and similar machines.
1 994. Machine for cutting and slicing vegetables.
United States 1 135 079. Corn topping machine.
1 135 187 — 1 137 652. Tractors.
1 135 288. Dust spraying machine.
1 135 559. Traction belt.
1 136 511. Tractive force measuring appliance.
1 137 101. Machine for raising and lowering well piping.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

37 - **Chemico-Analytical Researches on the Maturation of Grapes and their Conversion into Wine.** — BARAGIOLA, W. I., and GODET, CH., in *Landwirtschaftliche Jahrbücher*, Vol. XLVII, Part 2, pp. 249-302. Berlin, December 23, 1914.

The writers have studied the changes in composition of grape juice during the maturation of 10 samples of grapes of the Räuschling variety collected each week during the period August 27 to October 27, 1912; also the changes in composition of the wine made with the same variety of grapes, during and after fermentation.

The changes observed by the writers are compared with those found by W. KELHOFER in 1907 in grapes of the same variety. The detailed results are collected in numerous tables and illustrated by numerous diagrams. The most important of these results are summarised in Tables I-II.

TABLE I. — *Changes in the compos*

Properties or components of the juice.	Changes occurring from Aug. 24 to Oct. 28, 1907 (favourable year)
1. Specific gravity (Oechsle degrees).	Gradual increase from 19° to 68.1°
2. Invert sugar	The curve follows exactly that of the specific gravity du (0.77—14.76 %)
3. Total acidity	Increases from 31.7 % to 35.3 % Nov. 7, then decr to 13.1 %.
4. Ratio: $\frac{\text{Oechsle degrees}}{\text{Sugar content}}$	Gradually falls from 2.47 to 4.6.
5. Extractive without sugar . . .	Increases first from 41.4 to 45 gms. per litre (Sept. 7) decreases to 29.1 gm. per litre.
6. Total nitrogen	Gradual increase from 0.263 to 0.899 gm. per litre.
7. Ammoniacal nitrogen.	. . . . .
8. Protein nitrogen	. . . . .
9. Ash	Increases regularly from 2.0 to 3.1 gms. per litre (from fruit alone without stalks).
10. Potassium	. . . . .
11. CO_3 radicle	. . . . .
12. PO_4 radicle	. . . . .
13. Alcalinity of ash (FARNSTEINER).	. . . . .
14. Sulphates	. . . . .
15. Free sulphurous acid	. . . . .
16. Fixed sulphurous acid	. . . . .
17. Organic acids not determined by titration	. . . . .
18. Organic acids determined by titration.	. . . . .
19. Malic acid	. . . . .
20. Tartaric acid	. . . . .
21. Tannic acid.	Falls almost to zero (juice from grapes alone)

grape juice during maturation.

Changes occurring from April 27 to Oct. 27, 1912
(unfavourable year).

ıcrease from 28° on Aug. 20 to 55° Oct. 8, then constant.

ıe two years

(25.8-110 gms. per litre October 8) .

ecreases from 33.5 to 17.6 gms. per litre Oct. 8, then remains constant.

alls from 10.9 to 5.0-5.2 end of Sept., then remains constant.

ecreases from 46.8 to 35 gms. per litre ; decreases more slowly than in 1907.

ıcreases from 0.47 to 0.91 gm. per litre Oct. 15, then remains constant.

ıcreases very slowly from 0.25 to 0.27 gm. per litre.

ıcreases uniformly as maturation progresses, then with the advent of an unfavourable period remains constant.

enerally increases from 2.8 to 3.16 (juice from whole branches with stalks)

ery considerable increase, then decrease from Oct. 8 to 22, followed by a further increase.

ecreases with decrease in organic acids and their salts.

ontinuous increase.

iminishes fairly regularly from 33.5 to 16.5 cc. N. on October 22.

ifference between sulphates in juice and ash is 1.5 to 3.8 cc. N.; the latter being 2 to 4 times greater than the former.

emains almost constant.

ıcreases as the maturation increases.

emains almost constant.

ecreases uniformly until October 8.

alls rapidly and uniformly. At the beginning $^5/_6$ is in the free state and at the end the free acid is more than double that in the half-combined condition.

alls uniformly but less rapidly. At the beginning of the experiment $\frac{1}{3}$ is in the free state and on Oct. 8 the free and combined acid are in equal porportion.

eneraly falls, but remains above that of 1907.

TABLE II. — *Changes in wine during and after fermentation.*

Properties and constituents of wine	Changes occurring between Oct. 21, 1912, and January 6, 1913.
Specific gravity	Falls rapidly from 1.0537 to 1.0030.
Alcohol content	Directly after fermentation attains the definite amount of 6.3 % in volume.
Total extractives and sugar-free extractives	Falls throughout the fermentation period, then remains almost constant.
Acidity	Falls very slowly but continually from 16.4 to 14.7 gms. per litre.
Total nitrogen	Falls considerably during fermentation (from 1.19 to 0.82 gms. per litre in 2 weeks), then remains constant.
Nitrogen as ammonia	Diminishes especially at the beginning of fermentation (from 0.31 to 0.19 gm. per litre in 1 week).
Nitrogen as protein	Diminishes more strongly towards the end than at the beginning of fermentation.
Ash.	Weight diminishes rapidly during fermentation, then very slowly (in all from 3.292 to 2.104 gms. per litre).
Alkalinity (after FARNSTEINER)	Diminishes rapidly and constantly during and after the fermentation (from 17.9 to 5.0 cc. N.).
Strength in sulphates	Diminishes during fermentation and increases again after fermentation.
Potassium	Diminishes by one half after fermentation.
PO_4 radicle	The absolute quantity diminishes a little, but the percentage increases about 7.5 %.
CO_3 radicle	Diminishes considerably after the formation of tartrates and other organic salts.
Mineral matter (pure ash)	Diminishes by about 30 % of the original quantity.
Acidity (organic)	Diminishes regularly.
Malic acid	Falls slowly from 9.6 to 9.4 gms. per litre both in the free and in the fixed state.
Tartaric acid	Falls slowly from 5.0 to 4.8 gms. per litre; during the fermentation the portion in the free state increases slightly ; the portion in the fixed state diminishes slightly, then both portions diminish.
Tannic acid	Falls slowly from 0.26 to 0.29 gm. per litre.

By means of these data and the meteorological records for 1907 and 1912 the writers show the connexion between the maturity of the grapes and meteorological conditions.

After a period of 10 months during which metabisulphite of soda was added at the rate of 6 gms. per hectolitre and the wine was drawn off and placed in fumigated casks, the wine was analysed again on November 17, 1913, when it was found that the only change of any importance was an increase in the concentration of sulphates, which rose from 3.8 to 7.5 cc. N. per litre. In consequence of this the alkalinity by FARNSTEINER'S method had dropped from 5.0 to 2.4 cc. N. The organic acid content remained almost the same, owing (in the opinion of the writers) to the low temperature of the cellar. A sample of the same wine fermented and stored at the ordinary temperature during the same period without any other treatment diminished in total acidity from 192 to 122 cc. N. (equivalent to 36.4 per cent) as a result of the biological decomposition of the acid. During this decomposition 124 cc. N. of malic acid were changed into 65 cc. N. of lactic acid. Further, the total nitrogen content and the ammoniacal nitrogen content were greater in this wine kept at a higher temperature. It is therefore possible to change the very acid wines of eastern Switzerland into fairly sweet wines by keeping them at a higher temperature in casks not excessively fumigated.

The writers refrain from generalising from these results, since they only concern one variety of grape, and were obtained in an unfavourable year.

738 **–The Influence of Sulphurous Acid upon the Fermentation Processes due to Yeasts and Bacteria in Wine, Perry and Cider.** — MÜLLER-THURGAU, H., and OSTERWALDER, A., in *Landwirtschaftliches Jahrbuch der Schweiz*, Year 28, Part 4, pp. 480-548. Berne, 1914.

During the last few years the writers hawe been continuing their researches as to the the way in which sulphurous acid acts in wines and ciders. These earlier researches, like those of other investigators, had given very divergent results and, in the case of certain phenomena, had afforded no satisfactory explanations. Their present object was to obtain a satisfactory solution of the question under discussion by the employment of more accurate methods. The sulphurous acid was introduced in the form of potassium metabisulphite into the unfermented or partially fermented juice of fruit and grapes; after one hour, or sometimes a longer period, had elapsed the amount of free and combined sulphurous acid was determined according to Ripper's method by titration with a $^{N}/_{50}$ iodine solution. The numerical results of these experiments, which are given in numerous tables, have led the writers to the following conclusions:

In order to estimate exactly the effect of sulphurous acid, when introduced into fruit and grape juice or into wine either by fumigation or by the addition of potassium metabisulphite, and to be able to determine accurately the amount necessary for retarding and regulating the fermentation and also for preventing disease, it is necessary to be acquainted with the method of action of sulphurous acid. That is to say whether it

occurs free or in combination, and, further, the comparative capacity of the different juices and wines for fixing sulphurous acid. The latter capacity depends essentially upon the soundness and the degree of ripeness of the fruit. The juice of grapes infected by *Botrytis* possesses the power of fixing sulphurous acid to a much greater extent than that of healthy grapes of the same kind. In the case of pears the property of fixing sulphurous acid increases with the ripeness of the fruit, the increase being especially striking when the pears become soft. The juice of soft pears can immediately and completely fix considerable amounts of this compund (300 mgms. and more per litre). The increased power of fixing sulphurous acid occurring in grapes attacked by *Botrytis* does not depend directly on their higher oxydase content, but probably on the amount of acetic aldehyde present. The great capacity for fixing sulphurous acid shown by "sleepy" pears must also be attributed to their high aldehyde content. The same applies in the case of over-ripe apples. In these juices a very pronounced and rapid fixation of sulphurous acid, in the form of stable sulphurous aldehyde, takes place, while other juice free from aldehyde (that of sound grapes, various sound apples, not over-ripe, and pears rich in tannin) fix sulphurous acid less quickly and in lesser quantity in the form of a compound that contains glucose and is less stable than sulphurous aldehyde. In the juices first mentioned there is found besides sulphurous aldehyde, if the quantity of aldehyde is small, sulphurous glucose and free sulphourous acid. In the other juices, which are free from aldehyde, only sulphurous glucose and free sulphurous acid are found. During the subsequent cellarage of the unfermented juice of fruit and grapes the sulphurous acid, in the presence of air, is more or less rapidly transformed into sulphuric acid. The sulphurous aldehyde, on the other hand, proves to be very stable, even in the presence of a certain amount of air. When in addition to free sulphurous acid there is also sulphurous glucose present, the former is first converted by oxidation into sulphuric acid. The state of chemical equilibrium is then destroyed, a further dissociation of the sulphurous glucose taking place, and by the gradual conversion of this dissociated portion into sulphuric acid the complete disappereance of the sulphurous acid is eventually brought about.

During fermentation the sulphurous acid, which, on the addition of the potassium metabisulphite, had at once combined with the aldehyde, remains unchanged. This sulphurous aldehyde proves to be stable even in the presence of organic ferments. On the other hand, the sulphurous glucose is decomposed in proportion as the glucose is converted into alcohol by fermentation, while the sulphurous acid which is liberated subsequently behaves as free sulphurous acid. Directly fermentation begins, the sulphurous acid is no longer converted by oxidation into sulphuric acid on account of the liberation of carbonic acid. It is, however, fixed very quickly and is subjected to a subsequent oxidation whereby it is changed into sulphuric acid.

During alcoholic fermentation acetic aldehyde is produced as an intermediate compound between sugar and alcohol. This combines with

the free sulphurous acid when it is present and is thus subjected, in the form of sulphurous aldehyde, to a further reduction to alcohol. As the aldehyde of fruit is gradually reduced to alcohol during fermentation, only a small portion of the sulphurous acid added during this process is fixed at once, the greater part remaining at first in a free state and being only gradually fixed by the aldehyde that forms. When the sulphurous acid is not added until towards the end of the fermentation, a large amount remains at first in a free state. If slight fermentation is again produced, part of the sulphurous acid can subsequently be fixed by means of the aldehyde in the form of sulphurous aldehyde. Later, by the action of the oxygen of the air, the free sulphurous acid is gradually oxidised into sulphuric acid, but some of it can also be fixed by the acetic aldehyde produced by the oxidation of the alcohol.

Only free sulphurous acid is capable of retarding, or even preventing, fermentation; the sulphurous acid first fixed by the aldehyde has not this property. Probably the sulphurous glucose is not without a retarding action on fermentation in view of its ready decomposition into glucose and free sulphurous acid. Yeasts can stand a certain amount of free sulphurous acid, in the presence of which they slowly begin to grow and produce fermentation.

The amount of sulphurous acid necessary to prevent alcoholic fermentation is very different in the case of different juices, for this action only depends on the sulphurous acid that remains free, and the property of fixing sulphurous acid varies considerably in the juices of grapes and other fruits. Fom this point of view the nature of the initial yearst flora must also be taken into account, for the various species or races of yeast have not the same powers of resistance to sulphurous acid. The oxydase content may also exercise some influence in this respect, since the suphurous acid disappears more rapidly in juices rich in this ferment. If the sulphurous acid kills all the yeast cells quickly or exercises a slow paralysing effect, gradually destroying them, no fermentation takes place at all. But if only the most susceptible cells are killed and the remainder, owing to their greater resistance, are not affected, the latter resume their activity as soon as the amount of sulphurous acid has undergone a certain decrease. The particular moment when the sulphurous acid is added is also not without effect upon the result; in the juice of newly pressed grapes the effect of the addition of a certain amount of sulphurous acid is greater than if the same quantity were added after the fermentation had begun, because in the latter case part of the free sulphurous acid would be fixed by the aldehyde produced during the fermentation process. The reverse is the case in the juice of "sleepy" pears, for the aldehyde present in the fruit immediately fixes a considerable amount of the added sulphurous acid, whereas at a more advanced stage of fermentation the fruit aldehyde has in a large measure disappeared.

The biological decomposition of malic acid, which in the wines serving as the objects of these experiments was caused usually by *Bacterium gracile*, can be prevented by the addition of smaller quantities of free

sulphurous acid than are necessary for hindering to any great extent, or completely suppressing, alcoholic fermentation. To prevent the decomposition of the acids in wines and ciders poor in acid content, the best plan is to add the sulphurous acid before fermentation, for the decomposition of the former compounds often begins during alcoholic fermentation, or shortly after its cessation.

Small quantities of free sulphurous acid are sufficient to prevent wines having a taste of lactic acid. In the case of perry rich in aldehydes and poor in acids (made from over-ripe or sleepy pears), larger quantities must always be added, for a considerable amount of the sulphourous acid is fixed by the fruit aldehyde. Consequently if some of the aldehyde has disappeared owing to fermentation, a smaller amount of sulphurous acid is required. Sulphurous aldehyde, however, if present in large quantities, can also have an unfavourable action on the sensitive lactic acid bacteria.

739 – **Dealcoholised Wine, a New Product of the Wine Industry**. — CETTOLINI, S., in *L'Italia Agricola*, Year 52, No. 5. Piacenza, May 15, 1915.

Dealcoholised wine is a quite different product from so-called alcohol-free wine. The first is obtained from real wine produced by the fermentation of grape-juice, and then deprived of its alcohol, while the latter is unfermented grape-juice that has been filtered, sterilized, rendered sparkling by the addition of carbonic acid and bottled.

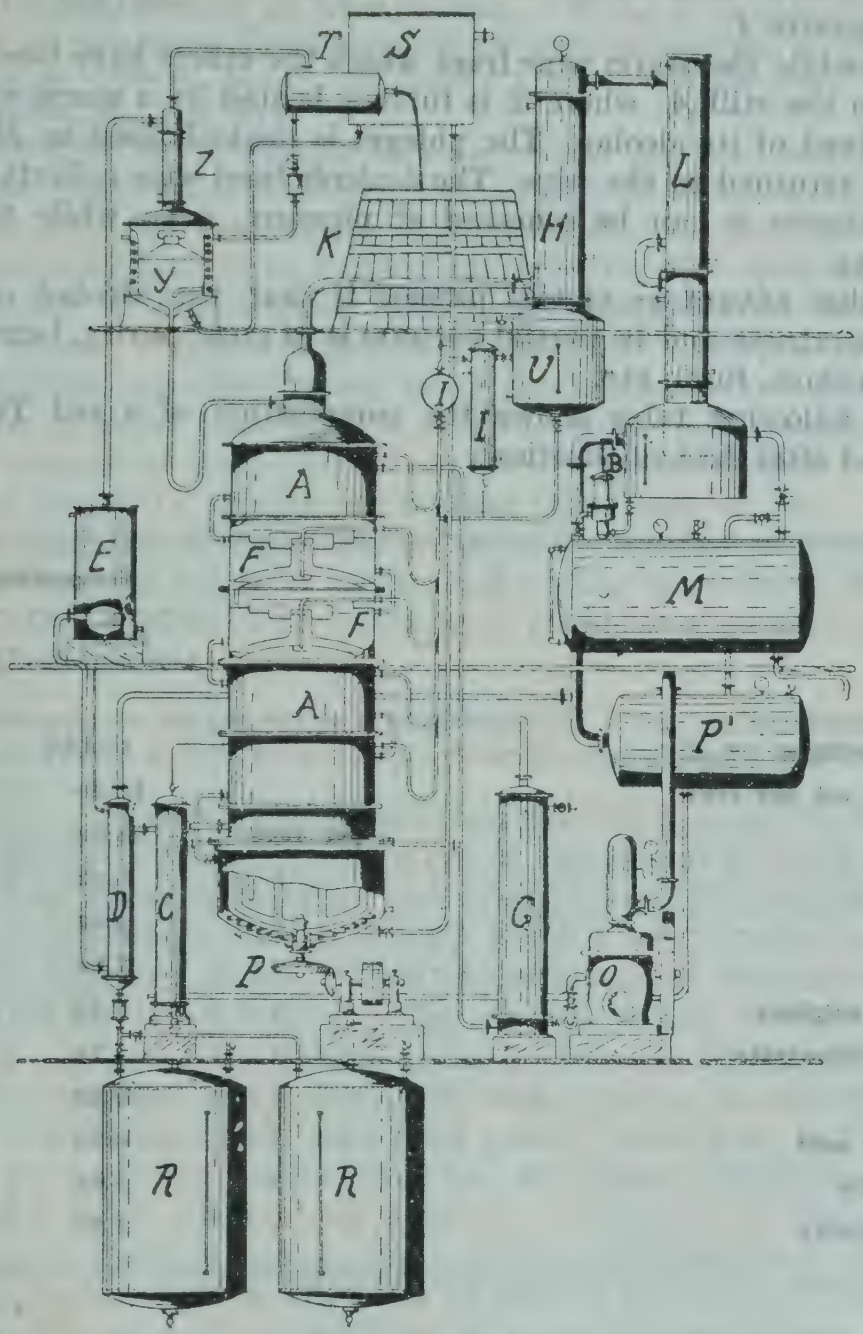
Dealcoholised wine as prepared by Dr. GINO CIAPETTI'S process and by the plant devised by him, contains all the components, minus alcohol, which go to make up real wine, and among others the ethers (ethyl-acetic, butylic, propylic, etc.) and aldehydes to which its pleasant taste and stimulating properties are due; it contains also the same acids, and especially tannic acid which has such a protective action against the germs of cholera and typhus, as has been demonstrated by Prof. TAVERNARI of the University of Modena and by BODIN at Rennes.

The operation of depriving wine of its alcohol must be carried out in such a way as not to lose any of its other valuable constituents, and this is done by a fractional distillation under relatively low pressure.

The very small quantities of ethers and higher alcohols which give the perfume to wine are separated at 25 to 30° C. (77 to 86° F.), the ethylic alcohol is then extracted at 50 to 55° C. (122 to 131° F.), after which the ethers are mixed with the remaining wine, and the result is a wine containing less than 1 per cent of alcohol, and all the other components of wine in a slightly increased quantity, with the exception perhaps of some of the volatile acids. The lack of these is made good by the addition of carbonic acid, which, together with a small quantity of sugar (about 3 per cent) in the case of a very dry wine, render it very palatable.

The dealcoholisation of wine is accomplished in Dr. Ciapetti's apparatus (see figure). The wine enters into the distributor *T*, whence it flows into the apparatus as soon as a sufficient vacuum is formed by the pump *O*. In *K* the ethers and higher alcohols distil over; the wine then enters the boiler Y. The more volatile portions rise in the column *Z* where the ethers are separated from the small quantities of alcohol which accom-

New plant for the continuous dealcoholisation of wine.



A. Distilling column.
B. Alcoholometer.
C.L. Coolers.
D. Ether emulsifier.
E. I. Worms.
F. Water-bath.
G. Water heater.
H. Dephlegmator.
K. Ether and higher alcohols separator.
M. Alcohol receiver.
O. Vacuum pump.
P. Pneumatic chamber.
R. Tanks for the dealcoholised wine.
S. Boiling-water tank.
T. Distributor.
U. Y Boilers.
Z. Absorbing column.

pany them. From *Z* the ethers descend into the worm *E* in which they condense and fall into *D* where they mix intimately with the dealcoholized and cooled wine which comes from *A* after having passed through the refrigerator *C*.

Meanwhile the warm wine from which the ethers have been extracted flows into the still *A*, where it is further heated by a warm-water jacket and deprived of its alcohol. The phlegm is dealcoholised in *H*, *U*, and *I* and then returned to the wine. The dealcoholised wine collects eventually in *R R*, whence it can be removed at pleasure, even while the work is progressing.

Another advantage of this process is that the alcohol obtained at low temperatures and in partial vacuum is of great purity, being free from higher alcohols, fusel, etc.

The following table shows the composition of a red Tuscan wine before and after dealcoholisation:

	Composition of wine	
	Before dealcoholisation	After dealcoholisation
Specific gravity at 15° C.	0.9967	1.0067
Alcohol by vol. per cent.	10.20	0.60
Extract . . . . . per 1000	24.64	24.66
Glycerine . . . . . »	6.22	6.25
Tannin . . . . . »	2.02	2.05
Glucose . . . . . »	1.62	1.55
Potassium sulphate . . . . . »	1.10	1.12
» bitartrate . . . . . »	3.15	3.20
Ash . . . . . »	2.52	2.50
Phosphoric acid . . . . . »	0.32	0.33
Total acidity . . . . . »	7.65	7.42
Volatile acidity . . . . . »	1.70	1.55

BREWING AND DISTILLING

740 — **The Proteolytic Enzymes in Malt.** — WESTERGAARD, EMIL, in *Journal of the Institute of Brewing*, Vol. XXI, No. 4, pp. 344-355. London, April 1915.

The writer gives the results of experiments which show the presence of two forms of peptolytic enzymes as well as a proteolytic enzyme in germinating barley. The latter, which causes the hydrolysis of proteins to peptones, has an optimum temperature between 133° and 136° F. (56° and 58° C.); the two peptolytic enzymes, which hydrolyse the peptones to amino-acids, have optimum temperatures between 77° and 99° F. (25° and 37° C.); one of them is destroyed at 122° F. (50° C.) and the activity of the other is greatly decreased at this temperature.

The optimum temperatures of these enzymes are of considerable importance in brewing, since yeast possesses extremely little proteolytic activity but considerable peptolytic activity.

741 - **On the Colloidal Swelling of Wheat Gluten.** — UPSON, F. W. and CALVIN, J. W (Laboratory of Agricultural Chemistry of the University of Nebraska) in *The Journal of the American Chemical Society*, Vol. XXXVII, No. 5, pp. 1295-1304, figs. 1-3, 2 plates. Easton, Pa., May 1915.

These experiments on wheat gluten are almost identical with those of WOOD (*Journal of Agricultural Science*, Vol. 2, 1907). Starch-free gluten prepared by washing dough in distilled water was made into discs of uniform size. The discs were placed in varying concentrations of acids and salts and their increase in weight noted. The experiments showed that gluten behaves like animal colloids in that salts retard the absorption of water from acid solution, non-electrolytes being much less effective than salts. The absorption of water from an acid solution of given concentration increases with increase of temperature. Aqueous extracts of flour and bran have an effect similar to, though less marked than, that of salts.

It is considered that these results are of importance in relation to certain theoretical and practical problems of milling and baking, and also in relation to the problem of the mechanism of water absorption and secretion by living plants.

742 - **Durra *(Sorghum vulgare)* as a Substitute for Wheat in Bread-making.** — CASELLI, ALBERTO, in *L'Agricoltura coloniale*, Year IX, No. 4-5, pp. 217-227. Florence, April 30-May 31, 1915.

At the suggestion of the writer, Prof. GASPERINI, Director of the Hygiene Bureau for the City of Florence, carried out an experiment in bread-making using wheat flour mixed with 25 per cent of durra flour. The sorghum grain employed was of the white Feterita variety, which is very common in Egypt and the Anglo-Egyptian Sudan. The total whiteness of the grain renders it most suitable for bread-making. The average weight of 100 seeds of this variety is 2.57 gms.; the weight of the bushel is 61.88 lbs. The flour is of excellent quality, being fine, soft and smooth, its colour white inclining to pink. It was mixed with good quality wheat flour in the proportion of 25 per cent. The resultant loaf was well risen, light, with smooth, brownish-yellow, hard, friable crust adhering completely to the crumb; this latter was uniform in colour, light, elastic, with numbers of small round eyes uniformly distributed, while its flavour was excellent, superior to that of other bread made from wheat with the addition of rice, rye or potatoes. The following table giving the results of numerous analyses, permits of a comparison between the constitutuents of sorghum and those of other cereals.

Analysis of a sample of bread made with a mixture of wheat flour and 25 per cent of sorghum flour gave the following percentages: starch 50.79, ash 1.66, fats 0.44, nitrogenous matter 8.33, water, 35.23, fibre (by difference) 3.55.

Sorghum is imported in considerable quantities into Europe, where it is employed for various purposes; in Austria, for instance, it is used for feed-

Comparative analyses of durra and other cereals.

	Water	Nitrogenous matter	Fats	N — free extract	Crude fibre	Ash.
North African durra flour. . .	10.69	10.96	3.88	68.99	2.66	2.82
North American » » . .	11.00	10.30	4.20	69.90	1.50	1.60
Abyssinian » » . .	14.20	10.04	6.67	64.96	2.43	1.10
Hungarian » » . . .	19.87	10.43	3.83	62.58	2.12	1.17
Hungarian » » . .	10.58	9.56	4.18	81.43	1.86	2.97
Sudanese » » . .	11.45	11.07	2.68	70.30	1.95	2.57
Feterita » » . . .	8.45	12.98	3.30	72.45	1.03	1.71
Wheat flour.	16.00	15.50	1.80	62.50	6.10	2.10
Rye »	13.37	11.19	1.68	69.36	2.16	2.24
Maize »	13.00	9.6	3.2	71.7	1.4	1.1
Barley »	12.95	9.68	1.96	68.51	4.40	2.50
Potato »	74.93	1.99	0.15	20.86	0.98	1.09

ing poultry and calves, in England for the manufacture of alcohol, starch and beer and also as a cattle feed.

Other bread-making experiments had been made in Italy in 1892; they did not give uniform results, but in these cases the quality of the grain employed was itself variable. The writer gives comparative figures showing the amount of broad and fine bran and of flour in sorghum, wheat and maize respectively. He also gives the results of experiments made on samples of bread of pure durra and of wheat mixed with different proportions of durra, in comparison with bread from rye, maize and wheat.

The following conclusions have been reached :

1. Durra is a complete food containing a sufficient amount of proteid substances and a large quantity of starch.

2. Its grain yields less bran than wheat and consequently more flour : about 79 per cent.

3. It lends itself better than maize flour to bread-making and very well to mixing with wheat flour.

4. Sorghum bread contains much more nitrogenous matter than maize bread (on an average 7 per cent as against 4 per cent).

743 – **The Utilisation of Cotton Stalks in Paper-Making**. — OLDS, W. C., in *Journal of the Royal Society of Arts*, Vol. LXIII, No. 3259, p. 580. London, May 1915.

A pulp mill of 50 tons daily capacity is being erected at Greenwood, Miss. (U. S. A.) for the manufacture of pulp for paper-making from cotton stalks. In view of the increasing scarcity of pulp materials throughout the world this process will be of great economic value to both the paper-making industry and cotton growers. The annual supply of cotton stalk

in the United States is estimated at 75 million tons, capable of producing 24 million tons of paper worth more than £ 10 per ton.

The fibre of the cotton stalks consists of a thin-walled tube which collapses in a peculiar twisted manner in the beating process and interlaces in the felting process much better than any other fibre, thus forming a strong flexible and durable tissue of light weight and with double the tensile strength of stock used as ordinary wrapping paper.

When nitrated it forms an efficient and convenient form of smokeless powder.

744 – **Preliminary Study of the Relations between the Composition of Raw Rubber and the Mechanical Properties of the Vulcanised Product.** — CHENEVEAU, C.; HEIM, F.; MARQUIS, R., in *Bulletin de l'Office Colonial*, Year 8, No. 87, pp. 128-133. Melun, March 1915.

Since the industrial value of a sample of rubber depends upon the physical properties of the vulcanised product, the value of raw rubber is best determined after vulcanisation. Experiments made with a series of samples of rubber of *Manihot glaziovii* and *Hevea* show that the figures expressing the value of the rubber in terms of its mechanical properties are proportional to the ratio between the combined sulphur and the caoutchouc contained in the raw rubber, *i. e.* the coefficient of vulcanisation. Thus the greater the percentage of caoutchouc in a sample of rubber, the greater will be the quantity of combined sulphur; at least, with rubbers of different botanical origin, the vulcanisation value of the rubber is generally proportional to the percentage of caoutchouc.

Other experiments tend to show that the protein substances exert the greatest influence on the coefficient of vulcanisation, and that the numerical value of a type of rubber varies according to the variations in the quantity of protein, with a maximum corresponding to a certain ratio between the quantities of caoutchouc and protein.

This maximum value, which varies with the botanical species of the rubber, can be considered as the optimum numerical value of the grade, and may be called the optimum quality of that particular grade. The study of a series of *Manihot* rubbers shows that the optimum ratio $\frac{\text{protein}}{\text{caoutchouc}}$ is reached in rubber from trees of a certain age, which should be considered as the optimum age for exploitation.

Thus an appreciation of the influence of the various cultural factors on the optimum ratio provides a criterium for a rational system of rubber cultivation. Similarly the optimum method of coagulation will be that which assures the precipitation of pure rubber and proteins as nearly as possible in the same proportion as the optimum ratio. It is also necessary to modify current opinion regarding the market value of a sample of rubber and to establish a valuation based on the mechanical properties of the vulcanised product rather than on the percentage of pure caoutchouc.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

745 – **On the Presence of "Complements" in Milk.** — HEWLETT TANNER, R. and REVIS, CECIL, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, I. Abt.*, Vol. 75, No. 4, pp. 337-347. Jena, January 1915.

The specialists who had studied this question being far from unanimous as to the presence of complements in milk (1), the writers determined to carry out further researches on the subject. They examined the blood of a single healthy cow, a mixture of the milk of several healthy cows, colostrum, and the milk of cows affected with very slight inflammation of the udder or of animals with defective udders.

The method followed was that of PFAUNDLER and MORA, but the doses used were those recommended by BAUER, *viz.* milk 1 cc., 0.5 cc. of a 5 per cent suspension of the corpuscles from the blood of guinea-pigs, 0.2 cc. of inactive bovine serum. The writers drew the following conclusions from the results of their experiments :

Milk after calving (colostrum) until the end of the lactation period may contain " complements ". Colostrum and the milk of cows suffering from mastitis contain larger amounts of these substances than ordinary milk. The milk of cows affected by mastitis may also contain the " amboceptor " (1), but its presence is impossible to detect when this is mixed with other milk. " Complements " can be recognised in colostrum, even if the latter is diluted with other milk in the proportion of 5 per cent. Even in the lightest forms of mastitis, the " complements " are present in the milk long after the inflammation has ceased ; nevertheless their occurrence is not a specific diagnostic character of the milk of cows suffering from this disease. It is not possible to find any connection between the number of the cellular elements and the presence of " complements ", although the appearance of the latter is often accompanied by an increase in the number of the former. The above-mentioned haemolytic method is an extremely delicate test of milk. The real nature of the " complements " of milk is still little known.

746 – **Experiments in Pasteurising Milk by means of the " Universalpasteur " in Denmark.** — LUND, A. V., in 86de *Beretning fra den Veterinaer- og Landbohøjskoles, Laboratorium for Landøkonomiske Forsog* (86th Report of the Agricultural Research Laboratory, Royal Veterinary and Agricultural College, Copenhagen). — *Communicated by the Danish correspondent, Baron* ROSENKRANTZ.

Whereas in Danish butter and cheese factories it was formerly only the cream and a portion of the skimmed milk used in cheese-making that were pasteurised, it is now almost the rule to pasteurise the whole milk before separation.

(1) If certain cells (bacteria, blood corpuscles, spermatozoa) are introduced into the blood of animals, antibodies variously known as *immunising bodies*, *amboceptors* or *sensibilisers* are formed. Alone these antobodies are incapable of exerting any immunising action, but in combination with certain substances normally present in the blood and called *complements*, they form *cytotoxins*, which have the property of destroying the very cells to which they owe their origin. (cf. HAMMARSTEN : *Lehrbuch der physiologischen Chemie*, p. 71. Wiesbaden, 1910) — See also No. 725 above. (*Ed*)

In Denmark, under the law dealing with the measures for combating tuberculosis in domestic animals, the pasteurisation of all skimmed milk and buttermilk given to cattle, so that it gives a negative reaction to Storch's test (1), is obligatory; *i. e.* the milk must be heated to at least 80° C., the fatal temperature for tubercle bacilli.

Of recent years, the body appointed to superintend the enforcement of the said law has received a relatively large number of milk samples giving a positive reaction to Storch's test, although the managers of the dairies maintained that the thermometer had registered several degrees above the critical temperature. On further enquiry it was found that the apparatus used for heating the milk was the "Universalpasteur", a regenerative heating apparatus made by Buaas of Aalborg. This machine is so arranged that the milk, after being heated, is cooled before leaving the pasteuriser, a point which has made it popular in dairies where the milk is pasteurised before separation. In order to clear up the matter a number of experiments were carried out and gave the following results.

1. If the milk from an ordinary pasteuriser has, on reaching the weighing receptacle, a temperature that would still allow of a positive reaction to Storch's test, the capacity for such reaction can be neutralised by the enttrance into the vessel of superheated milk added subsequently.

2. This, however, cannot happen if the milk comes from a "Universalpasteur" or similar apparatus, for the milk is cooled immediately and before it leaves the apparatus. Hence, if milk capable of giving a positive reaction enters the weighing receptacle, it retains that capacity in spite of any subsequent rise, however great, in the pasteuriser itself.

3. The reading of the thermometer on the "Universalpasteur" taken at the same time as the sample thus affords no evidence as to how the milk in the weighing receptacle will react.

4. A relatively small quantity of milk capable of positive reaction can, when added to the volume of milk in the weighing receptacle, cause the former to react. Hence, as mixing is continually taking place, the milk in the receptacle can give a positive reaction a considerable time (even several hours) after the actual milk capable of causing the reaction has emerged from the "Universalpasteur".

5. As the various milk particles probably have somewhat different temperatures when they reach the top of the "Universalpasteur", and the thermometer can only register *one* temperature at a given moment, the latter must always be higher than the critical temperature of the reaction (80-81° C.) in order that the least warmed particles of the milk, and consequently the whole bulk of the milk, shall not give a positive reaction.

6. For this reason, the maker now makes a point of mentioning in the directions for using his apparatus that the thermometer should always register at least 83° C. if the milk is to pass Storch's test. This arrange-

(1) The determination of the peroxydase in the milk by means of a 2 per cent paraphenylenediamine solution. (Cf. SOMMERFELD, *Handbuch der Milchkunde*, p. 727. Wiesbaden, 1909). (*Ed.*)

ment will doubtless be all that is needed, and the working of the machine is not affected thereby.

7. The rapidity with which the milk cools after being heated seems to have no effect upon its reactive capacity.

8. The milk of Jersey cows and of goats behaves in a precisely similar manner to that of Danish cows in respect to its reaction to the Storch test.

747 – **The Alcohol Test in Relation to Milk.** — AYERS, S. H., and JOHNSON, W. T., in *Bulletin of the Department of Agriculture*, No. 202, pp. 1-35. Washington, D. C., May 12, 1915.

The alcohol test has been adopted in various European countries as a reliable test for indicating the quality and condition of milk samples. It usually consists in mixing 2 cc. of milk with an equal quantity of 68 per cent alcohol, and any resulting precipitate is taken to mean that the milk is abnormal, owing either to a pathological condition of the cows which produced it or to changes caused by bacterial fermentations.

As authorities are by no means agreed on the value of this test, a series of experiments was carried out to determine its reliability under various conditions. A distinction was established between tests made on the milk from individual cows and those made on mixed samples as drawn from market supplies. Milk from a single cow was shown to yield a precipitate for a period after calving which might extend to 25 days, but it was found at the same time that such milk would not seriously contaminate a consignment from a herd, as the positive reaction was only obtained when the colostrum milk made up 80 to 90 per cent of the total bulk.

The remaining experiments were made on ordinary mixed market samples. The results confirm those of other investigators in that a precipitate was obtained with the alcohol test when lactic acid or rennet-forming fermentations had occurred, but no definite relation was observed between the alcohol test and the number of bacteria in the milk, owing probably to the fact that bacteria may increase in large numbers before there is much acid or rennet produced. Moreover, as the bacterial flora of market milk is very varied, many species of organisms may increase without influencing the alcohol test. Nor was the test a better indication of the bacterial condition of the milk when carried out by a different method, *viz.* when a definite volume of milk was titrated against alcohol until a precipitate was produced.

Taking the result as a whole, it would appear that a positive reaction with the alcohol test indicates a certain abnormality in milk and should be taken as a sign that the source of supplies and subsequent handling of the product must be investigated.

748 – **Experiments in Cheese-making from Milk of Different Fat Contents.** — LUND, A. V., in 86de *Beretning fra den Kgl. Veterinaer- og Landbohøjskoles, Laboratorium for Landøkonomiske Forsøg* (86th Report of the Agricultural Research Laboratory, Royal Veterinary and Agricultural College, Copenhagen). — *Communicated by the Danish correspondent, Baron* ROSENKRANTZ.

In Denmark, where cheese-making has recently received considerable impetus owing to the different measures adopted for its promotion,

dairy cheeses have always been differentiated into distinct types according to the amount of whole milk present in the "cheese milk" (a mixture of whole milk, skimmed milk and butter-milk). The cheeses are known as: entirely whole-milk cheese (*Helt Södmaelksost*), half whole-milk cheese (*Halv Södmaelksost*), quarter whole-milk cheese (*Kvart Södmaelksost*), etc., down to skimmed milk cheese (*Skummetmaelksost*) in the preparation of which no whole milk is used.

As a means of distinguishing between these various classes of cheeses, either at exhibitions, or on the market, the proportion of fat content to albuminoid content was used. For this purpose, about 14 years ago, the Experimental Laboratory compiled a table (based on numerous analyses) giving the ratios in the different classes.

Subsequently the dairy managers proposed that these figures should be revised and others added expressing the ratios for fresh and stored cheeses, the coarse or fine division of the curd, similarly those for cheeses made with pasteurised and unpasteurised milk, the milk of Jersey cows, etc. Investigations were begun, and led to the following results:

1. The coefficient of the cheese, *i. e.* the relation between the fat content and the albuminoid content, can be very accurately estimated from the fat percentage of the "cheese milk" and, conversely, the fat percentage can be calculated from the coefficient. The factor to be used in the case of the milk of ordinary Danish cows is 37 ½ ($= {}^{3}/_{8} \times 100$).

2. It follows that the coefficients of the different kinds of cheese known commercially as whole-milk cheese, half and quarter whole-milk cheese and skimmed-milk cheese are sufficiently distinct to allow of the various kinds being distinguished by their means. In spite of the very considerable variations in the values of the same sort of cheese, it has been found that the minimum values found for whole-milk cheeses are higher than the maximum values for half whole-milk cheeses, while the minimum value for the latter are in their turn higher than the maximum values of quarter whole-milk cheese, and so on.

3. Such factors as whether the cheese is made with pasteurised or unpasteurised milk, and whether the curd is coarsely or finely divided, certainly exert some influence upon the coefficient of the cheese, but not to the extent of appreciably modifiying the conclusions in § 2.

4. The coefficients remain almost the same whether the cheese analysed is fresh or has been kept some time. The method of storing also has little effect upon the coefficients as determined by analysis.

5. As the coefficients determined by the experiments are merely experimental figures, and do not correspond to the conditions obtaining in practical cheese-making, in trade, or at exhibitions, they cannot be used as type values, but may serve as guides for the determination of the latter.

6. The yield of cheese can be roughly estimated when the amount of fat and albuminous substances in the "cheese milk" is known.

7. Cheeses made from the milk of Jersey cows were found to have higher coefficients than those made from the milk of ordinary Danish cows;

yet the coefficients of the former were relatively too low, owing to the large amount of albuminoids in the milk of Jersey cows.

8. In the case of the milk of the Jersey cow, the factor 37 ½ given in § 1 cannot be used; it is necessary here to employ the factor 30 ($= {}^{3}/_{10} \times 100$).

9. The milk of Jersey cows gave a much larger cheese yield than ordinary milk; this is entirely due to the larger fat and albuminoid content of the former.

10. Judging from a single examination, there is no characteristic difference between the quality of cheese made from the milk of Jersey cows and that made from the milk of ordinary Danish cows.

11. Any given "cheese milk" can be altered by the addition of skimmed milk or whole milk (or even cream), in such a way as to obtain the desired coefficient in the cheese to be produced.

749 - **A Method for the Estimation of Chlorides in Cheese**. — CORNISH, E. C. V., and GOLDING, J. (Dairy Research Laboratories, University College Reading), in *The Analyst*, Vol. XL, No. 470, pp. 197-203, 1 fig. London, May 1915.

The usual method of estimating chlorine in cheese by water extraction from the incinerated solid and subsequent titration with silver nitrate gives unsatisfactory results unless the incineration is performed at a very low temperature.

The writers have devised a more rapid and more accurate method as follows: about 1 gram of cheese is ground in a mortar and placed in a Kjeldahl flask with about 20 cc. of strong nitrogen-free sulphuric acid and a few small pieces of pumice are added; the flask is connected to a wash-bottle containing a solution of silver nitrate and nitric acid. Since the corks of the flask are liable to corrode under the action of the strong acid fumes, they are dispensed with and the vapours drawn through the wash-bottle by attaching the latter to an aspirator pump. To prevent condensation of the acid vapours in the neck of the flask during distillation, heat is applied to the neck either by means of another burner or by a water-bath.

When the reaction is completed (1 ½ hours) the silver chloride is filtered off and the residual silver nitrate determined by Volhard's method of titration with potassium thiocyanate and iron alum.

The accuracy of the method was determined using pure sodium chloride and the following results obtained :

Amount taken	Amount found
0.246	0.2469
0.1128	0.1139
0.2362	0.2364
0.184	0.1865
0.1005	0.0993
0.0879	0.0886

Further experiments with cheese were then carried out, giving the following results :

Chlorine expressed as sodium chloride in white and discoloured portion of Stilton cheese.

Discoloured portion		White portion	
1. 2.519 per cent		1. 2.617	
2. 2.468 » »		2. 2.750	
3. 2.432 » »		3. 2.536	
	Maximum Error	4. 2.584	
Average 2.473	± 1.6 per cent.		
		Average 2.622	Maximum Error ± 4.9 per cent.

The results show no marked difference in the chlorine content of the discoloured and the white parts of the cheese, but the degree of accuracy which may be expected from this method may be seen from them.

The advantages of this method over that of incinerating and water extraction seem to be: 1) Greater accuracy and rapidity; there is no danger of loss of chlorides, and no necessity for lengthy and careful heating. 2) The same cheese residue, in the same flask and with the same sulphuric acid, may be used for the nitrogen estimation in the solid cheese by Kjeldahl's method, part of the necessary heating having been carried out in the chlorine estimation.

750 – **A Bacteriological and Chemical Study of Commercial Eggs in the Producing Districts of the Central West.** — PENNINGTON, M. E. (Chief, Food Research Laboratory); JENKINS, M. K.; ST. JOHN, E. Q.; and HICKS, W. B. — *Bulletin of the U. S. Department of Agriculture*, No. 51, 77 pp., 8 coloured plates. Washington, 1914.

Fresh eggs. — Are those which are not more than 24 hours old and which are kept in a cool place. Previous investigations by Mr. PENNINGTON have shown that they contain an average of 2 organisms per gram in the white and 6 per gram in the yolk with an incubation temperature of 37° C, and respectively 7 and 9 organisms per gram with incubation at 20°. These eggs were gathered between February and November inclusive, and opened under aseptic conditions. STILES and BATES, who did not clean the shells before opening them, found higher figures. MAURER reported 81.9 per cent of the eggs he examined to be sterile and stated that of the 18.1 per cent infected, 82 per cent were infected in the yolk, 25.9 in the white, and only 7.9 per cent in both yolk and white.

The bacterial content of fresh eggs varies considerably as regards the character of the organisms present but their numbers are small. Neither PENNINGTON nor MAURER found *Bacillus coli* in fresh eggs opened after cleaning and it may be affirmed that it is practically never present in the well handled fresh egg.

Egg protein in fresh eggs contains a minute quantity of loosely bound nitrogen which is split by the action of a weak alkali. This form of nitrogen is much increased, thought still small in account, in eggs that have deteriorated, and its amount is at the present time the best and simplest index of the chemical stability of the egg. The analyses made by the writers show that most of the loosely bound nitrogen is found in the yolk of the egg.

where it averages 0.0023 per cent. Whole eggs gave 0.0013 per cent as average. The maximum and minimum variations are 0.0019 and 0.0015 per cent respectively.

The moisture content attains its maximum in August and September, when the industry considers the quality of the eggs lowest. In the early spring when the quality of eggs is highest the water content is lowest, and in autumn it occupies an intermediate position. It may be that there is a connection between the amount of water present in the egg and its resistance to decay. Some analyses by the writers gave the following percentages of moisture :

Spring	in the white	87.90,	in the yolk	47.44
Summer	»	88.19	»	47.96
Autumn	»	87.99	»	47.54

As a general average (from the writers' and other analyses) moisture in the fresh whole egg may be taken at 72.44 per cent.

The fat of an egg is almost exclusively in the yolk. The ether extract of the yolk varies from 33.33 to 31.44 per cent, the average being 32.68.

All the above data refer to new-laid eggs.

Market eggs. — Unincubated eggs. The writers call "stale eggs" those that show an enlarged air space and the yolk commonly above or below the normal position, and "settled yolks" those in which the yolk has become more opaque and has fallen to the pointed end of the shell. Generally their odour is good and their taste not objectionable.

Incubated eggs. The writers distinguish between : 1) those eggs that show before a candle a small darkened area on the yolk, as in eggs that have been incubated for about 24 hours at 103° F. ; 2) those that before the candle show blood rings about the germinal disk (eggs which have been incubated about 48 hours). In these two classes the embryo was either alive or only very recently dead and the odour of the egg when opened was good ; 3) eggs in which the embryo was dead, where incubation had continued for more than 48 hours, and the white and yolk were not well separable. The odour was sometimes good and sometimes stale.

An examination of the total bacterial content of individual eggs opened aseptically, showed that the greatest percentage of second-grade food eggs examined, the medium stale eggs, hatch-spot eggs, dirty eggs, cracked eggs, and eggs with yolk partially mixed with albumen, contained less than 1000 bacteria per gram. *B. coli* were not present in the whole-shelled second-grade eggs and present in only 5.9 per cent of the cracked-shelled eggs.

Blood rings and the last five types of eggs represent eggs ordinarily discarded as unfit for food purposes. 26.5 per cent of the eggs with adherent yolks, 50 per cent of the eggs with dead embryos, 75.9 per cent of the mouldy eggs (mostly *Penicillium*, almost always accompanied by bacteria), 66.7 per cent of the " white rots " (eggs in which the yolk is partially mixed with white), and 100 per cent of the black rots contained over 1000 organisms per gram. With the exception of the white and black rots, *B. coli* were present in but few of the eggs.

The results obtained in the laboratory with samples made up with several eggs of the same class and *opened commercially* showed :

1. That the samples of July and August firsts contained very few organisms and in many cases no bacteria of the *B. coli* group.

2. The majority of the samples of clean shelled seconds had a comparatively low bacterial content, only 8.3 per cent of them containing over 1 000 000 organisms per gram.

3. The percentage of bacterial counts over 1 000 000 per gram in samples of dirties, checks, eggs with yolk partially mixed with albumen, was 16.6, 18.8, and 20 per cent respectively. No greater number of *B. coli* was found in these samples than in samples of seconds.

4. The samples of blood rings contained comparatively few organisms. The large blood rings in most instances showed more infection than the small rings. Most of the specimens contained less than 10 *B. coli* per gram.

5. The amount of protein decomposition as shown by the ammoniacal nitrogen in the preceding six types of eggs was greater (as would be expected) than that found in strictly fresh eggs, but was no greater than that found in some grocery eggs. Although a cracked or dirty shell may be a factor in facilitating infection and subsequent decomposition, the data obtained show that checks and dirties are as well preserved as the clean whole-shelled seconds or the July and August firsts.

6. The eggs constituting the samples of July and August firsts, seconds, dirties, and checks can be used without compunction by the household, baker or confectioner.

7. The majority of the samples of the white rots, eggs with yolk lightly adherent to shell, and all the samples of sour eggs, black rots, eggs with green albumen, and eggs with yolk heavily adherent to the shell were infested with bacteria. *B. coli* were present in most of these samples, forming the predominating organisms in the samples of sour eggs.

8. The eggs with the yolk lightly adherent to the shell were, chemically, slightly lower in quality than were the second-grade food eggs, whereas the sour eggs, white rots, eggs with green albumen and eggs with yolk heavily adherent to the shell showed much more deterioration. Black rots had five times as much ammoniacal nitrogen as any of these types of eggs. With the exception possibly of the eggs with yolks lightly stuck to the shell, none of the eggs in these samples would be used by the housewife or reputable baker or confectioner.

751 – **Recent Experiments on the Storing of Grapes in Various Gases.** — DALMASSO, G., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXI, Series V, No. 10, pp. 217-219. Conegliano, May 15, 1915.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

A few years ago Prof. SANNINO carried out some experiments on the storing of grapes in inert gases, with the object of preventing their drying up or turning mouldy. The grapes, however, while retaining for a certain length of time a good appearance externally, acquired a taste which showed that some fermentation had taken place rendering them unfit for the table.

The writer has repeated the experiments, first with inert gases, such as carbon dioxide and deoxygenated air, then with active gases, such as ozo-

nised air and oxygen, but with no better results. With carbon dioxide, both in the diffused light of the laboratory and in the darkness of the cellar, alcoholic and butyric fermentation took place. With deoxygenated air, after 53 days, alcoholic fermentation set in with liberation of carbon dioxide. With ozonised air and with oxygen the colour kept better, but fermentation had set in as in the case of deoxygenated air.

In practice, therefore, though this method prevents the formation of mould and preserves the appearance of the grapes, it is not to be recommended, for in less than two months the composition and taste of the fruit is much altered.

752 – **The Use of Sulphur and Lime in the Storage of Potatoes.** — SHANDER, R., in *Deutsche Landwitschaftliche Presse*, Year XLII, No. 40, p. 361. Berlin, May 19, 1915.

The writer gives the results of three years' experiments, those of the last year being given in detail. To four heaps of potatoes (Up-to-date) were added 0.5 or 0.25 per cent of quicklime and 0.15 or 0.05 per cent of sulphur. A fifth heap remained untreated as a control. The results of this experiment are given in the appended table :

Heap	Treatment	Initial weight of tubers stored in autumn	Weight of sound tubers in spring	Weight of half rotten tubers	Weight of rotten tubers	Total weight of unsound tubers	Loss in weight	Percentage sound	Percentage rotten	Percentage loss in weight
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
1	0.5 % lime	4 862	4 302	178	166	345	216	88.5	4.4	7.1
2	0.25 » »	5 326	4 591	281	128	408	327	86.2	6.1	7.7
3	0.15 » sulphur . . .	5 591	4 602	257	324	579	409	82.3	7.3	10.4
4	0.05 » » . . .	5 326	4 589	369	144	513	225	86.2	4.2	9.6
5	control	5 459	4 717	253	218	471	271	86.4	4.9	8.6

It thus results that sulphur is of no value in preventing potatoes from rotting, the percentage of rotten tubers being even higher in the treated heaps. Experiments during the winter of 1913-14 showed that the germinating power of potatoes treated with sulphur had diminished in a notable manner.

On the other hand the heaps treated with quicklime showed a lower percentage of rotten tubers than the control heaps, as in the case of previous experiments. A great advantage in the use of quicklime consists in its drying effect on rotten tubers, forming as it does with the liquid resulting from the putrefaction a solid mass which prevents the spread of the disease to healthy tubers.

Since potatoes treated with lime acquire a rather dirty appearance, this treatment is only employed for the storage of seed tubers and those intended for the manufacture of alcohol. For table purposes potatoes are pre-

served in peat-dust, the disinfectant effect of which is well known and which absorbs moisture from the tubers. From 1 to 2 lbs. per cwt. of potatoes are required.

Dry sand is less effective and more expensive than either peat-dust or lime.

These methods of preservation may be used for potatoes stored in cellars, in which case the height of the heaps should not exceed 2 ft. 6 in. in winter and 2 ft. in summer, so as to prevent the development of too high a temperature, which favours rotting.

PLANT DISEASES

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

753 - **Plant Diseases studied in India in 1913-14.** — See above, No. 671.

754 - **Determination of the Maturity of Sugarcane in relation to Fungoid and Insect Pests.** — See above, No. 714.

RESISTANT PLANTS

755 - **New Variety of Hop, Resistant to Aphis and Eelworms.** — See above, No. 715.

MEANS OF PREVENTION AND CONTROL

756 - **Note on Copper Spraying Mixtures** (1). — FONZES-DIACON, in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1915, 1st Half-year, Vol. 160, No. 16, (April 19 sitting), pp. 528-530. Paris, 1915.

The researches of the writer show that acid mixtures contain most tetra-cupric sulphate; they also contain in solution free copper sulphate and the elements of tetra-cupric sulphate; their fungicidal action is very remarkable.

Alkaline sprays contain very little tetra-cupric sulphate; the supernatant liquid contains in solution copper bicarbonate, which decomposes very rapidly by the action of the air, yielding the less active copper hydrocarbonate.

DISEASES OF VARIOUS CROPS

757 - **Fungus Diseases of Cassava (*Manihot* sp.) in Trinidad.** — RORER, JAMES BIRCH, in *Bulletin of Department of Agriculture, Trinidad and Tobago*, Vol. XIV, Part 2, pp. 36-68. Port-of-Spain, Trinidad, 1915.

Cassava in Trinidad has been comparatively free from diseases up to the present. This is undoubtedly due to the fact that this plant is, or rather was, grown as a catch crop interspersed at wide distances among other crops.

(1) See also *B.* Oct. 1914, No. 954; *B.* Nov. 1914, No. 1069. (*Ed*).

Under these conditions fungus diseases cannot spread rapidly or produce much damage; certain plants are attacked here and there, but the infection does not take on an epidemic character.

This state of things is about to change, owing to the requirements of three factories recently established in the island, involving the planting-up of extensive lands under this crop. Considerable attention is therefore required to prevent serious losses in the future.

The diseases attacking cultivated manioc consist of: 1) leaf diseases; 2) stem diseases; and 3) root diseases.

Leaf diseases attributed to different species of *Cercospora* (*C. manihotis*, *C. cassavae*, *C. henningsii*) and to *Gloeosporium manihotis* have been recorded in Brazil, the neighbouring countries of South America, Cuba, Florida and Tropical Africa. Species of *Cercospora* cause leaf-spots, whilst *G. manihotis* attacks the petiole, causing the wilting of the entire leaf. Two leaf diseases are generally known in Trinidad; one, known as "white leaf-spot", is only slighthy injurious, while the other, known as "brown leaf-spot", causes premature shedding of the leaves.

At San Paulo (Brazil) two stem diseases have been recorded, of which the more serious is produced by *Bacillus manihotis*. The first mark of the disease is the appearance of small damp spots along the stem, which extend until the whole stem is affected; the leaves wilt and the stem falls over and breaks. *Gloeosporium manihotis*, already mentioned, is also the cause of a stem disease at San Paulo.

With regard to root diseases, a little-known rot of fungoid origin has been recorded in Jamaica, whilst in the East a bacterial rot is known to exist.

758 – ***Bacterium vascularum*** **causing Gummosis in Sugarcane in Java.** — GROENEWEGE, J., in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, Vol. V, Part 3, 7 figs. Soerabaia, 1915.

When young canes are attacked with gummosis the majority of the roots die. The stem becomes marked with red lines and numerous brown-coloured cavities appear. There is also a remarkable excess of buds produced. The red lines are continued into the leaves, which have white striations later turning brown. Finally the leaves dry up completely. The leaves of diseased plants have sometimes great difficulty in unfolding, since the surrounding leaves are fused together at the edges. Month-old plants may take the disease.

In the case of ripe cane the red coloration does not extend beyond the nodes and increases more and more towards the tip of the stem. In the case of the "sareh" disease (1) the red coloration also occurs, but it increases towards the base of the stem. All buds become diseased in young cane, whilst on ripe canes both diseased and healthy buds occur. The woody elements of the roots contain masses of bacteria as well as gum. The phenomena are more accentuated in the stem, but both bacteria and gum are only found in the woody tissues.

(1) See *B.* May 1915, No. 553. (*Ed.*)

Pure cultures of the bacteria may easily be obtained from various parts of the diseased plants, and infection experiments with these cultures have given positive results. The bacteria enter through the lesions of the roots and may spread from diseased roots to healthy neighbouring plants. The bacteria measure 0.7 μ × 0.3 μ; no spores have been observed.

COBB in Australia has described a disease of sugarcane which is identical with gummosis observed in Java and has established that *Bacterium vascularum* is the cause of this disease. *B. vascularum* belongs to the same group as *B. solanacearum*, but is distinguished from it by its different behaviour in nutritive solutions.

The red coloration of the bundles is a fairly general phenomenon in diseased cane and is due to enzyme action. The cavities are due to a drying of the tissues, and all other external phenomena of the disease are caused by disturbance in the transportation of water in the vascular bundles.

The same disease is found in almost all countries where sugarcane is cultivated.

In Java some varieties are almost immune, while others are very badly attacked. It is especially in soils which dry easily or where the roots are subject to injury that the disease causes most damage. Since the young plants soon die and the old ones attacked no longer produce shoots for propagation, there is no fear of spreading the disease by planting shoots from diseased plants, and disinfection of these is quite unnecessary.

759 - ***Phoma destructiva*, the Cause of a Fruit Rot of the Tomato in the United States and Cuba.** — JAMIESON, CLARA O. (Bureau of Plant Industry), in *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 1-20, plates A-B and I-VI. Washington, D. C., April 15, 1915.

In March 1912 the Bureau of Plant Industry received from Cutler, Florida, specimens of tomatoes affected with a fruit rot, which was stated to have caused great loss among the farmers of Dade County, Florida. Some of the fruits were green, some beginning to colour and others ripe. Most of the green and ripe fruits were marked on the sides and at the stem end with slightly sunken spots, the surface of which was membranous or crust-like, 1 to 3 cm. in diameter, brownish black in colour, with definite outlines. Tiny dark pustules were observed on the surface of the largest spots. On the ripe fruit the diseased tissue was surrounded by a more or less watery zone.

Microscopic examination showed that the diseased tissues of both green and ripe fruits contained a dense network of mycelium, with numerous pycnidia apparently belonging to *Phoma* as well as bacteria and sometimes spores of *Macrosporium*. However, the abundance of pycnidia in all spots examined suggested that the *Phoma* is the primary cause of the rot and this fungus was therefore isolated from the diseased tissues. Almost two years later an identical *Phoma* was isolated from tomatoes from Cuba and Florida showing a similar appearance.

With the cultures of this fungus, now more precisely determined as *Phoma destructiva* Plowr., the writer carried out a long series of inoculation experiments on green and ripe fruits and leaves of tomatoes (*Lycoper-*

sicum esculentum) under glass, on green and ripe fruits in the laboratory and on plants growing in the open air. The leaves of young and old plants were also inoculated with the cultures obtained from the fruits. Experiments were also conducted on the infective power of the fungus on egg-plants (*Solanum melongena*), the tubers and haulms of potato (*S. tuberosum*), sugar-beets (*Beta vulgaris*), *Datura tatula*, peas (*Pisum sativum*), beans (*Phaseolus vulgaris*) and pepper (*Capsicum annuum*).

These experiments showed that *Phoma destructiva* behaves as an active wound parasite on green and ripe tomatoes, and that it causes the formation of spots on the leaves of tomatoes and potatoes. The *Phoma* was also isolated from the inoculated tomatoes under glass, in the laboratory and in the open field. The behaviour of the fungus towards its host and its cultural characteristics are minutely described. The vitality of the *Phoma* fungus is considerable, stem cultures living for nearly a year. The perithecial stage of the fungus has not yet been observed in culture or on host tissue, but only the pycnidia. The minimum temperature for the development of this *Phoma* is about 6° C., the optimum about 28° C. and the maximum between 32° and 33° C.

Besides the above localities, the parasite has been recorded from Florence (South Carolina), at Miamisville (New York) and at Herrington (Kansas) and it is probably still more widely distributed.

760 – **Formalin as a Spray against American Gooseberry Mildew** (1). — *Deutsche Landwirtschaftliche Presse*, Year XLII, No. 36, p. 329. Berlin, May 5, 1915.

B. PANTEN, of Kazmierz, Posen, reports the results of spraying with a 1 per cent solution of 40 per cent formalin against American gooseberry mildew (*Sphaerotheca mors-uvae*). The bushes were sprayed in early spring before the appearance of the leaves and again before flowering, taking care to wet all the wood and both leaf-surfaces.

By this method the lichens and mosses growing on the older bushes were effectively destroyed. During 1913 and 1914 the bushes sprayed were quite free from attack, whilst those in neighbouring plantations were very severely attacked. Bordeaux mixture (2) had been tried for three years without success, as all the bushes had become attacked by the disease.

761 – **Sources of the Early Infections of Apple Bitter-Rot (*Glomerella cingulata*).** — ROBERTS, JOHN W. (Bureau of Plant Industry), in *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 59-64, plate VII. Washington, D. C., April 15, 1915.

The researches of different investigators on apple bitter-rot in America have shown that *Glomerella cingulata*, the fungus causing it, can pass the winter in mummied apples of the preceding year and also in the cankers produced by the fungus, from which infection begins in the succeeding year. Other plants than the apple may serve as sources of infection.

According to observations made by the writer in the Ozarks (Arkansas), the fungus can winter on almost any cankered or dead parts of the diseased

(1) See also *B.* Dec. 1914, No. 1188. (*Ed*).
(2) See *B.* Nov. 1913, No. 1301. (*Ed*).

trees, including the cankers due to the Illinois apple-tree canker fungus (*Nummularia discreta*), in the dead tips of fruit spurs, the dead parts of limbs due to injury by freezing or death of the roots on one side of the tree, branches injured by mechanical means, cankers caused by the pear-blight organism (*Bacillus amylovorus*) and by the apple-blotch fungus (*Phyllosticta solitaria*).

The cutting-out of cankers greatly reduced the number of early infections of the disease, though removal of all small dead parts is obviously practically impossible.

762 — **The Treatment of Peach Leaf-Curl *(Exoascus deformans)*.** — GANDOLFI, C., in *Il Coltivatore*, Year 61, No. 14, pp. 435-437. Casale Monferrato, May 20, 1915.

The writer reports experiments carried on for several years in Northern Italy on protecting peaches from the attacks of leaf-curl. Fifteen ungrafted trees in the open were used, as well as 7 ungrafted cordons on trellis and 8 more against a south-west wall protected above by an 18 in. glass roof.

Of the 15 trees in the open, 6 were covered in February with a muslin net stretched to the tops of four poles and supported by two cross canes; the remaining 9 were left uncovered and sprayed twice with Bordeaux mixture, at the end of November and again in the middle of February.

None of the cordons were sprayed with Bordeaux mixture, but those on the trellis were covered with a similar net, except for two in the middle of the row.

The result was that none of the covered-in trees, whether sprayed or not, showed any trace of leaf-curl; the others were all badly attacked even when treated with the fungicide. The difference was particularly striking in the case of the trellis trees, where the two uncovered trees alone were diseased, those almost touching them on either side being pefectly free. The wall-cordons protected by the glass roof were also free from infection.

The writer recommends his method to small growers as inexpensive and an important factor in ensuring a healthy growth and continued fruitfulness. Effective covering with a muslin net so as not to intercept air and light assures an almost constant setting of the flowers.

763 – ***Pseudomonas citri* n. sp., the Cause of Citrus Canker in the United States.** — HASSE, CLARA H., in *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 97-100, plates IX-X. Washington, D. C., April 1915.

Microscopic examination of the branches, leaves and fruits of the grapefruit (*C. decumana*) received in 1914 from Florida, Texas and Mississippi showed that the Citrus canker was due to a bacterium and not to a fungus as previously supposed.

A micro-organism was isolated from a large number of cultures, and on inoculating young plants the characteristic symptoms of the disease appeared after a period of incubation of one week.

The organism was isolated from these inoculated plants and successful re-inoculations were made on healthy plants. The organism is therefore considered to be the cause of Citrus canker and has been described as *Pseudomonas citri* n. sp.

704 - ***Rhizina inflata* as a Parasite of Conifers in America** (1). — WEIR, JAMES R., in *Journal of Agricultural Research*, Vol. IV, No. 1, pp. 93-95, plate VIII. Washington, D. C., April 1915.

In the spring of 1912 seedlings of *Tsuga heterophylla*, *Larix occidentalis* and *Pinus monticola* in a part of the Kaniksu National Forest, Idaho, where the brushwood had been burnt, were observed to be dying in small isolated patches. The roots of these seedlings were found to be covered by a white mycelium. In the absence of any fruiting bodies in the immediate vicinity, the death of the plants was attributed to *Armillaria mellea* (Vahl) Quél., which is very abundant in the region and frequently the cause of the death of very young growth. The mycelium had penetrated all parts of the cortical and bast tissues of the roots, which were saturated with resin, as in the case of infection with *A. mellea*.

Later in the season, near the borders of the areas occupied by the dead seedlings, there appeared fruiting structures which were recognised as those of *Rhizina inflata* (Schäff.) Sacc. (= *R. undulata* Fr.). It was also found that these fruiting structures were connected with the mycelium in the roots of the diseased seedlings. A solution of the soil from the burnt area was infected with the spores of this fungus and sprayed about the base of healthy seedlings of *Pinus monticola* growing on burnt land in another part of the forest. In the autumn of 1912 the plants appeared somewhat backward and by July 1913 they were dead. The roots of each were attacked by the mycelium described above, whilst the stems and leaves remained unaffected, thus giving confirmation of the parasitism of *R. inflata*.

According to UNDERWOOD this fungus has been recorded in the following States : Connecticut, New York, Rhode Island, Pennsylvania, Wisconsin, North Carolina and South Carolina.

The writer has recently observed the fungus on *Pinus monticola*, *Tsuga heterophylla*, *Larix occidentalis* and *Abies grandis* in Idaho ; on *Pinus contorta*, *P. ponderosa* and *P. monticola* in Montana ; on *P. divaricata* in Minnesota ; and finally also on *Pseudotsuga taxifolia* in British Columbia (Canada).

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

765 - **New Jersey Acarina.** — WEISS, HARRY B., in *Entomological News*, Vol. XXVI, No. 4, pp. 149-152 and 183. Philadelphia, April 1915. GENERALITIES

In this preliminary list of the Acarina or mites known in New Jersey the following species occur :

1. *Bryobia pratensis* Garman (clover mite), on leaves of clover and fruit trees.
2. *Tetranychus bicolor* Bks., on apple, silver maple (*Acer saccharinum* L.) and other plants.
3. *T. bimaculatus* Harvey, the common "red spider" of greenhouses ;

(1) See also *B.* Aug. 1912, No. 1232. (*Ed.*)

attacks roses, carnations, palms, violets, etc., under glass; in some sea sons a pest on outdoor plants (1).

4. *T. pilosus* on fruit trees.
5. *Microtrombidium locustarum* Walsh, on eggs, nymphs and adults grasshoppers.
6. *Macrocheles marginatus* Herm., on the beetle *Allorhina nitida* (2).
7. *Tarsonemus pallidus* Bks., on chrysanthemums under glass.
8. *T. waitei* Bks. (peach bud mite): attacks terminal buds or shoots peach, usually on nursery trees.
9. *Pediculoides ventricosus* Newport: attacks larvae of grain moth (*S totroga cerealella*) and *Bruchus quadrimaculatus*.
10. *Pediculopsis graminum* Reuter: found in connection with bud-rot carnations in greenhouses; according to STEWART and HODGKISS th rot is caused by *Sporotrichum poae*; the mite appears to introduce th spores of the disease to the flower-buds. Treatment consists in prompt picking and burning all infested buds.
11. *Tyroglyphus farinae* De Geer: infests flour and stored foods.
12. *T. lintneri* Osb. (mushroom mite): sometimes destructive to mus rooms.
13. *Rhizoglyphus phylloxerae* Riley, in asparagus shoots.
14. *Eriophyes abnormis* Garman: forms pouch-like galls on upper side leaves of *Tilia americana*.
15. *E. crumena* Riley: forms small tapering galls on upper side of leaves *Acer saccharum*.
16. *E. aenigma* Walsh: forms irregular woolly tangles of leaf or flow buds on willows in early summer.
17. *E. amelanchieri* Steb. (June-berry gall-mite).
18. *E. avellanae* Jarvis (hazel gall-mite).
19. *E. betulae* Steb.: produces bud-galls on yellow birch (*Betula lutea*).
20. *E. caulis* Walsh: produces galls on petiole, ribs and large veins of leav of black walnut (*Juglans nigra*).
21. *E. dentatae* Steb., on *Castanea dentata*.
22. *E. pyri* Pgst. (pear-leaf blister-mite): on pear and sometimes appl occasionally destructive.
23. *E. quadripes* Shimer: produces pouch-like galls on upper side of leav of *Acer saccharinum*.
24. *E. querci* Garman (oak gall-mite), on *Quercus ilicifolia*, *Q. alba* and *prinus*.
25. *E. rhois* Steb. (poison-ivy gall-mite), on *Rhus radicans*.
26. *E. salicicola* Garman: produces galls on upper surface of willow leave
27. *E. semen* Walsh: produces galls on both surfaces of willow leaves.
28. *E. serotinae* Beut.: produces galls on wild cherry (*Prunus serotina*).
29. *E. ulmi* Garman: produces galls on upper surface of leaves of *Ulm americana*.

(1) See also *B.* Aug. 1913, No. 1014; *B.* Sept. 1913, No. 1122.

(2) See *B.* Sept. 1914, No. 864. (*Ed.*)

30. *E. viburni* Steb. : produces galls on leaves of *Viburnum dentatum.*
31. *E. ferruginea* Farlow (beech gall-mite), on *Fagus americana.*
32. *E. phlocopotes* : forms galls on plum.

766 – **Observations on the Rose Scale-Insect (*Aulacaspis rosae*)** (1). — NAKAYAMA, SHONOSUKE, in *Journal of Entomology and Zoology*, Vol. VII, No. 1, pp. 45-51, plates I-II. Claremont, California, March 1915.

Aulacaspis rosae Bouché has a very wide distribution. The observations here recorded were made at Stanford University, California, where it attacks various species of *Rubus* and roses.

The writer describes the different stages of development: adult female, egg and oviposition, hatching, first larval stage (active period), second and third stages of the female larva, male insect. There are four broods in the year.

Amongst its natural enemies the following were particularly abundant in 1913: *Chilocorus bivulnerus, Scymnus marginicollis* and a Hymenopterous parasite not yet determined.

767 – **New African Chalcididae.** — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. IX, pp 337-377, figs. I-XXIX. Portici, March 30, 1915.

MEANS OF PREVENTION AND CONTROL

The writer describes the following parasitic Hymenoptera as new to science :

1. *Eurytoma spermophaga* sp. nov., obtained from berries of an undetermined plant, whose seeds the larva gnaws, at Nefasit, Eritrea.
2. *E. elongatula* sp. nov., as above.
3. *Eucyrtonotus notabilis* gen. et sp. nov., as above.
4. *Zeteticontus abilis* gen. et sp. nov. ; according to observations made by the writer at Konakry, French Guinea, the females seek for larvae of *Nitidulidae* (*Carpophilus ?*) in fallen guavas and other soft fruits, laying one egg in each larva ; the larva of the parasite develops within its host, which is killed before reaching full size.
5. *Blastothrix subproxima* sp. nov., parasitic on the female of a *Pseudococcus* living on *Acacia* sp. at Nefasit.
6. *Leptomastix superbus* sp. nov., obtained from a female *Pseudococcus* on a grass at Nefasit.
7. *Prochiloneurus pulchellus* gen. et sp. nov., as No. 7.
8. *Aëthognathus afer* gen. et sp. nov., from adult females of *Stictococcus diversiseta* Silv., at Aburi, Gold Coast.
9. *Coccophagus orientalis* How., var. *modesta* var. nov., from adults of *Lecanium* (*Saissetia*) *nigrum* at Cotonu (Dahomey).
10. *C. princeps* sp. nov., collected at Keren, Eritrea.
11. *Prococcophagus varius* gen. et sp. nov., as No. 10.
12. *Physcus seminotus* sp. nov., parasitic on a *Chionaspis* feeding on *Aloe* sp. at Nefasit.
13. *Azotus elegantulus* sp. nov., as No. 12.

(1) See also *B.* Aug. 1914, No. 797. (*Ed.*)

14. *Encarsia parvella* sp. nov., parasitic on species of *Aleyrodidae* at Lagos, Southern Nigeria.
15. *Eretmocerus diversiciliatus* sp. nov., as No. 14.
16. *Pelorotelopsella nigeriensis* sp. nov., obtained from a twig covered by *Stictococcus sjöstedti* Ckll., collected at Olokemeji, Southern Nigeria; as the *Stictococcus* was also attacked by larvae of Diptera, as well as by a Lepidopterous larva (*Eublemma ochochroa* Hamptn.) itself attacked by an *Elasmus*, it is impossible to say whether the newly-described insect is a primary or secondary parasite.
17. *Tetrastichus stictococci* sp. nov., parasitic on females of *Stictococcus diversiseta* Silv., but whether a primary or secondary parasite was not ascertained.
18. *T. giffardianus* sp. nov., parasitic on *Ceratitis giffardii* Bezzi, at Olokomeji and at Cotonu, Dahomey.
19. *T. dacicida* sp. nov., parasitic on *Dacus bipartitus* Graham, at Victoria, Kamerun.

768 – ***Abella subflava*, a New Parasite of the Eggs of the Chinch Bug *(Blissus leucopterus)* in Kansas.** — Mc Colloch, James W., and Yuasa, H., in *Entomological News*, Vol. XXVI, No. 4, pp. 147-149, figs. 1-3. Philadelphia, April 1915.

During the summer of 1914, the Department of Entomology of the Kansas State Agricultural College carried on an extensive investigation into the life-history of *Eumicrosoma benefica* Gahan, parasitic on the eggs of *Blissus leucopterus* (1). Between 75 and 100 thousand chinch bug eggs were collected in the field to determine the percentage of parasitism and for use in the life-history work. These eggs, collected regularly during the summer and divided into lots of 10 to 50, were placed in small vials and examined daily.

In a vial containing eggs collected on July 27 on crabgrass a small light greenish parasite was found on August 4. A careful examination showed that one of the eggs had a small round hole in the side of it, quite different from the emergence holes cut by *Blissus* or *Eumicrosoma*. This egg was attached to another from which a specimen of *Eumicrosoma* emerged. On August 10 another of these parasites was bred from a chinch bug egg collected from crabgrass on August 1, but in a different field from that collected on July 27.

One question connected with the life-history work on *Eumicrosoma* was to determine whether it had any other host than the chinch bug egg. For this purpose collections were made of all kinds of eggs found in the habitat of the chinch bug and its parasites. In these collections large numbers of eggs believed to belong to a leaf-hopper were taken, and in nearly every case they were parasitised by this same greenish parasite. The exit hole in these eggs was the same as that in the chinch bug egg.

This parasite has been determined by A. B. Gahan as *Abella subflava* Girault, widely distributed in the United States and in Australia and parasitic on the eggs of a Jassid that infests wheat straw.

(1) See *B.* June 1914, No. 588.

F.

Attempts to carry the life-history of this parasite through on chinch bug eggs have always given negative results. The females of *Abella* showed little interest in the eggs of *Blissus* when placed near them. The length of the adult life was found to range from 7 to 14 days when the insect was fed on sweetened water.

As a factor in the natural control of *Blissus*, *Abella subflava* plays a very insignificant part. The fact that only two parasites have been reared from the large number of eggs examined seems to indicate that parasitism of chinch bug eggs by *Abella* is accidental rather than natural.

769 – **The Principal Means of Control of the Most Usual Animal Pests** (1). — MARTELLI, GIOVANNI, in *R. Scuola superiore d'Agricoltura in Portici, Bollettino*: No. 3, Series IV (2nd edit.), 102 pp., 64 figs. Portici, 1915.

This work is a collection of the different methods of control of the commoner animal pests, prepared for the use of growers.

After discussing general principles the writer gives separate treatment to the various artificial methods (physical, mechanical, and chemical) and natural methods (insect parasites, domestic animals and rotations). Then follow alphabetical lists of the chief animal pests with their means of control, and of the host plants, with the names of the pests attacking them and reference numbers for the methods of control.

770 – **Insect Pests of Cassava (*Manihot* spp.) in Trinidad and Tobago.** — URICH, F. W., in *Bulletin of Department of Agriculture, Trinidad and Tobago*, Vol. XIV, Part 2, pp. 38-40. Port of Spain, Trinidad, 1915.

INSECTS INJURIOUS TO VARIOUS CROPS

The following insects are recorded on cassava :

1. *Lonchaea* sp. (bud maggot) : the most formidable of those observed in the two islands ; it attacks and destroys the young shoots, producing serious damage when widespread ; the best method of control is cutting and burning the shoots attacked every ten days.

2. A leaf-mite (Acarid) attacks the young leaves, which become dwarfed and spotted ; if the attack spreads, treatment with flowers of sulphur or lime-sulphur wash on the under surface of the leaves is recommended.

3. *Erinnys ello* L. (cassava hawk-moth) : not abundant, probably owing to the presence of two natural enemies, one of which, apparently *Telenomus*, feeds on the eggs, and the other, probably *Microgaster*, is parasitic on the larva.

4. *Lasiopteryx* sp. (gall midge), causing the formation of leaf galls ; it is attacked by one or two Hymenoptera.

5. *Corynothrips* sp., lives on the lower side of the leaves and is parasitised by a fungus (*Entomophthora?*).

6. The cassava lace-wing bug (*Tingitidae*) pierces the lower surface of the leaves and sucks the sap.

7. *Atta cephalotes* L. (parasol ant), recorded as causing defoliation of one manioc plant.

(1) See also *B.* June 1915, No. 655. (*Ed.*)

The writer also refers to pests observed in other countries. In Cuba: *Lagochirus obsoletus*, a Longicorn boring in the stems; the larvae of *Lonchaea chalybea* and of *Erinnys ello*. In St. Vincent: *Corythuca* sp., *Frankliniella* sp., *Corynothrips* sp., etc. In Southern Nigeria: *Zonocerus variegatus* defoliates the plant.

771 – **Observations on a Recent Invasion of Insects in Coffee Nurseries in Java.** — SENSTIUS, M. W., in *Mededeelingen van het Proefstation Malang*, No. 7, pp. 5-19, 3 figs. Soerabaia, December 1914.

Each August since 1910 young coffee plants whose roots appeared to be attacked by borers have been received at the Malang Experiment Station. Sometimes the bark also was destroyed at some distance from the ground. Generally the young plants attacked in this manner died, whilst more developed plants were almost always checked in growth.

Young plants of Quillon, Excelsa and Liberian coffee, as well as tea, are attacked in this manner.

In the soil near the damaged plants were found the larvae of *Opatrum depressum* (about 250 per sq. yard). These larvae cause damage to the plants, but it has not yet been determined if the adult beetles are also injurious.

Numerous Tipulid larvae were also found in the coffee nurseries, but whether they attack coffee roots is not yet known.

Trapping the larvae with pieces of potato is recommended, also spraying the soil before sowing with "carbolineum" diluted 1 in 250, or 1 in 500 after sowing.

772 – ***Phaonia (Hyetodesia) trimaculata (Diptera)*, a New Pest of Cabbages in Great Britain.** — WADSWORTH, J. T., in *The Entomologist's Monthly Magazine*, Vol. LI (3rd Series, Vol. I), No. 4 (No. 611), pp. 142-143. London, April 1915.

Whilst collecting larvae and pupae of *Chortophila brassicae* (cabbage-root fly) at Northenden, Cheshire, in July 1914, the writer found some larger larvae with different morphological characters.

These larvae pupated early in July, and after 15 to 21 days the flies emerged: three of these appeared on July 20, 23 and 24. From other pupae collected on February 11 and March 5, 1915, two adults appeared on March 15 and 18 respectively.

The insect has been determined by J. E. D COLLIN as *Phaonia* (*Hyetodesia*) *trimaculata* Bouché, a fly not previously recorded in Great Britain.

BOUCHÉ (1834) first described this species as *Anthomyia trimaculata*, stating it to be common in gardens and fiields and destructive to roots of cabbages, where it can be found in summer and autumn associated with *Chortophila brassicae*.

773 – **Bean Weevil *(Bruchus obtectus)* reported in Great Britain** (1). — EDWARDS, JAMES, and CHAMPION, G. C., in *The Entomologist's Monthly Magazine*, Vol. LI (3rd Series, Vol. I), No. 4 (No. 611), pp. 140-142. London, April 1915.

EDWARDS received from several seedsmen specimens of a *Bruchus* referred to *B. lentis* Boh., reported to be attacking the seeds of dwarf beans.

(1) See also *B.* Oct. 1912, No. 1480. (*Ed.*).

On examination these specimens were found to resemble *B. obtectus* Say rather than *B. lentis*. The former has long been known as injurious to seeds of *Phaseolus*; it is also known as *Acanthoscelides obtectus* Say and *B. irresectus* Fåhr.

Further, from specimens received from DAY the writer believes that this weevil may be identical with that described by DAY as *B. pusillus* Germ. var. *seminarius* Baudi. According to the writer the question whether the specimens of *B. lentis* in the POWER collection of the British Museum really belong to this species remains doubtful.

CHAMPION (who has examined EDWARDS' specimens and some from DAY) considers them all referable to the common species of North and Central America recorded by Sharp (1885) under the name of *B. obsoletus* Say (= *B. obtectus* Say, *B. pallidipes* Fåhr., *B. fabae* Riley). *B. pusillus* Germ. var. *seminarius* Baudi, of the Mediterranean region, presents several morphological differences.

The three specimens representing *B. lentis* Boh. in the Power collection, which came from Gravesend and Birch Wood (Kent), correspond perfectly to the typical specimens of this species, which is recorded as bred from imported Egyptian seeds.

A third species, *B. chinensis* L., was found in imported lentils and collected at Dartford and Darenth Wood (Kent), Putney (Surrey) and in the New Forest (Hampshire). It has also been recorded in several localities in China.

The type-specimen of *B. irresectus* Fåhr. is of Persian origin.

774 - **Cottonworm Moth *(Alabama argillacea)* on Strawberries in Minnesota** (1). — WASHBURN, F. L., in *Entomological News*, Vol. XXVI, No. 5, p. 207. Philadelphia, May 1915.

During the autumn of 1914 there was a considerable outbreak of the cottonworm moth as far north as St. Paul, Minnesota; the insect caused little damage, but roused the attention of the growers of late strawberries. The moths visit the fruits and may cause serious damage by inserting their proboscids.

According to the writer this is the first appearance of the insect at this latitude in Minnesota for thirteen years.

775 - ***Phloeotribus scarabaeoides* and *Ploeothrips oleae* injuring Olives in Chianti, Italy**. — CAMBI, G., in *L'Agricultura Pisana*, Year VI, Part 4, pp. 93-96, 3 figs. Florence, 1915.

The olive groves of Chianti are very seriously damaged by attacks of the beetle *Phloeotribus scarabaeoides* (*P. oleae*) (2) and by the olive thrips (*Phloeothrips oleae*) (3).

(1) For the geographical distribution of this insect as a cotton pest, see *B.* June 1911, No. 1737; *B.* Aug.-Sept.-Oct. 1911, No. 3049; *B.* April 1913, Nos. 360 and 438; *B.* July 1913, No. 801. (*Ed.*)

(2) See also *B.* Oct. 1913, pp. 1497 and 1501; *B.* Dec. 1914, No. 1197.

(3) See *B.* Aug.-Sept.-Oct. 1911, Nos. 3026 and 3027; *B.* June 1914, No. 585. (*Ed.*)

After describing the biology of the two insects and the nature of the damage to the branches, leaves, flowers and fruits, the writer observes that since the life of *Phlocothrips* is dependent upon the presence of *Phloeotribus*, in whose galleries it hibernates, it is more necessary to adopt measures against the latter insect than the former.

Since the olive bark-borer (*Phloeotribus*) seeks dead or dying branches on which to lay its eggs in the spring, a general pruning should be carried out during the winter of the branches thicker than one inch, followed by insecticidal spraying. The prunings should be completely destroyed or carefully disinfected by heat to kill the insects and eggs in the interior of the branches. It is also useful to tar carefully the wounds of the larger branches to prevent the insects from continuing their work of destruction.

776 - ***Tylenchulus semipenetrans*, Nematode attacking Orange in Algeria.** — TRABUT, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 6, p. 222. Paris, May 12, 1915.

Decay in orange trees, particularly frequent in those not grafted on bitter-orange stock, is generally attributed to gummosis alone.

The study of a serious outbreak of the disease in an old orange grove near Algiers led the writer to examine the rootlets, which he found attacked by the eelworm *Tylenchulus semipenetrans* Cobb. As its specific name singifies, the female eelworm only buries half its body in the root tissues; the free part of the worm becomes swollen by the development of eggs. This habit renders it easy of identification.

It was first described in 1913 by COBB, of the Department of Agriculture at Washington, who studied the ravages of the parasite in California. Since then it has been found in Spain, Syria and Australia, apparently following the migrations of *Citrus* trees. The Phytopathological Service of Algeria (1) has undertaken the control of this nematode by means of carbon disulphide and sulphocarbonates. Nurseries will also be inspected to prevent the spread of the parasite by means of young plants sold rooted in soil.

777 - **The Black Fig-Fly (*Lonchaea aristella*).** — SAVASTANO, L., in *R. Stazione sperimentale di Agricultura e Frutticoltura in Acireale, Bollettino* No. 17, pp. 1-4. Acireale, 1915.

From 1912 to 1914 the writer noted *Lonchaea aristella* Beck, damaging figs in the Sorrento peninsula (Naples). This species, which he calls the "black fig-fly", owing to the shiny black colour of the fly and to distinguish it from the Mediterranean fruit-fly (*Ceratitis capitata* Wied.) (2), which also attacks figs but does not occur in the province of Naples, is indigenous to North Africa; BECKER had recorded it from Egypt and the Canaries, without mentioning its host.

As a result of biological studies in the locality mentioned in 1913 and 1914 it was found that the fly lays its eggs under the scales of the apical opening during August when the receptacle is nearly ripe and still greenish;

(1) See *B.* April 1915, N. 439.

(2) See *B.* May 1915, No. 670. (*Ed.*)

ut if there happens to be a lateral hole in the pericarp bored by some other nsect this place is preferred for oviposition. In summer the eggs hatch in 2 o 3 days, and the larvae work their way towards the centre of the recept- cle, which soon changes from dark to pale green, becoming later yellow and nen livid. The receptacle bends over, the extremity opens and a putrid quid oozes out. The diseased receptacle may fall to the ground or may emain attached to the branch; in the former case, the larvae leave it and upate in the surface soil, the fly emerging after 7 to 10 days; in the latter ase the receptacle dries up and the larvae pupate inside it.

The insect makes a second and more serious attack in September, thus aving two summer and autumn broods. There may also be a spring rood, which attacks the spring-figs usually abundant here.

Figs at the top of a tree are almost free from attack, those at the centre nd base being most severely attacked by the insect.

From experiments and observations, it appears that *Lonchaea* does ot attack pears, peaches, grapes, olives, or citrus fruits. All varieties f figs, both black and white, are damaged by this pest in the Sorrento eninsula, but the Trojan fig, a much prized table variety, appears to be articularly subject to attack, whilst the variety Dottato is much less liable. The reason for the greater susceptibility of Trojan is due to the shape f the the receptacle, which has a free margin between the scales, offering better position for the deposition of the eggs; in other varieties the scales re arranged in a manner so as not to leave any margin and the eye is ntirely closed.

The pupae are able to hibernate in the receptacles of the late variety Natalino or Pasqualino, grown more as a curiosity than for its crop, which does not mature in autumn, so that some of the figs may survive mild vinters and ripen about Easter, whence the second name.

The spring-figs also assist in the life-cycle of this insect. In the Sorrento peninsula there are some varieties (Paradiso, Colombo), which produce them in abundance and thus enable the insect to live through the spring until summer.

It also appears that the eggs may be laid in damp cow-dung containing plenty of straw, thus enabling the insect to survive the period between June and August.

As means of control for this pest the writer recommends: 1) suppres- sion of the variety Natalino to prevent the hibernation of the insect; 2) destruction of the infested spring-figs to prevent the development of the spring brood; 3) destruction of the figs infested in summer, so as to diminish the number of second-brood individuals; 4) prevention of removal of figs from infested districts.

Immune varieties should be planted wherever possible.

778 - ***Stictococcus diversiseta* sp. nov. on the Branches and Fruits of *Anona* in the Gold Coast.** — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R.Scuola superiore d'Agricultura in Portici*, Vol. IX, pp. 379-388, figs. I-IX. Portici, April 9, 1915.

Amongt the scale-insects observed in the different regions of West Africa between August 1912 and February 1913 the various species of *Stictococcus* COCKERELL received the writer's particular attention on account of the very remarkable sexual dimorphism shown by some of them even from the first larval stages and because the discovery of the male might help to clear up the systematic position of the genus.

S. sjöstedti was widespread in Nigeria, Kamerun, Dahomey and the Gold Coast, while some specimens were seen near Konakry in French Guinea; but the hatching of the larvae was not observed and no male was found.

In the case of another species, described as new to science under the name of *S. diversiseta*, the writer was able to collect specimens of males and females at all stages from larva to adult, of which he gives detailed descriptions. This new species was found in abundance at Aburi (Gold Coast) on the branches and fruits of *Anona*, and also near Cotonou (Dahomey) on the branches of an undertemined plant.

From females of *S. diversiseta* collected at Aburi, the writer obtained specimens of two new parasitic Chalcidids, *Aëthognathus afer* Silv. and *Tetrastichus stictococci* Silv. (1).

With regard to the systematic position of the genus *Stictococcus*, the writer considers it necessary to accept LINDINGER'S proposition that it represents a new sub-family (*Stictococcinae*).

(1) See above, No. 767. (*Ed.*)

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

Ráb: A Unique System of Cultivating Rice in Western India

by

Sir EDWARD BUCK, K. C. S. I., L. L. D.

For some hundreds of miles along the western coast of India runs a range of mountains precipitous towards the Arabian Sea, but broken and undulating on the Eastern side of the ridge. Against this mountain wall, called the Western "Ghats" (or Passes), beats the torrential downpour of the summer monsoon, giving to the inland tracts on or beyond the summit rains which are heavier or lighter according to the varying amount of protection afforded by the different elevations. It is in certain extensive districts of the mountain area, covering some hundreds of sq. miles, where the rainfall is considerable that the unique method of rice cultivation known as the ráb system prevails. The meaning of the term "ráb" as used in this article is manure burned on the seed beds from which rice plants are transferred to the field. At one time the manure thus burned consisted mainly of branches and twigs of the trees and scrub bushes of the surrounding jungle. It has been suggested by WALLACE and others that the ráb system might be considered as a civilised adaptation of the custom practised by many aboriginal tribes in various parts of the world of making successive clearings in hill forest lands by burning the trees and vegetation in limited areas, passing on to new patches when the earlier clearing has been more or less cultivated. This custom, technically known as "Jhumming" in the eastern hills of India, as "Chena" in Ceylon and "Ladang" in Malaya, is also practised by the Maories of New Zealand and is common in some parts of Africa. Whatever its origin, the ráb system is now firmly adhered to by the rice growers of those regions in the Western Ghats where local conditions are favourable.

It was not unnatural that the apparent wastefulness of a system which involved the cutting and lopping of trees in wooded areas should call forth a protest from the newly organised Forest Department in India, and in 1856 the Government of Bombay resolved to forbid the use of their woods and forests for such purposes, arguing that, in as much as the ráb practice did not exist in the rice lands of other parts of India, it was an unnecessary waste of the natural resources of the country. Then came an answering protest from the cultivators who pleaded the beneficial effects of the system to their rice fields. The controversy led to a serious investigation by the Agricultural Department of the Bombay Province, the Director of which, Mr Ozanne, instituted what were considered decisive experiments. He found that ráb was better than unburnt manure; that burnt cowdung gave better results than burnt vegetation but that the latter was far superior to unburnt vegetable matter and even gave better results than unburnt cowdung. There was therefore something to be said for the burning. At any rate the system was pronounced to be justified and "rabbing" was upheld as the best known method of manuring under the particular conditions of the country where it was practised.

No attempt, however, was then made to explain the process so as to account, on scientific grounds, for its superiority. This has been the subject of more recent enquiry. Moreover in view of the fact that ráb material in the form of branches and loppings of trees and other vegetable matter is becoming increasingly difficult to obtain in sufficient quantity, while in the form of cowdung it is costly and also limited in supply, the attention of the scientific investigations has also been given to the question whether cheap and efficient substitutes for ráb can be found.

Before entering upon the scientific issues which have been raised, by subsequent investigations, it seems desirable to draw attention to some general features of the whole system.

Three points deserve notice:

1) that the rice is *transplanted* from a seed-bed to the field;
2) that the *seed-bed*, not the field, is *manured*;
3) that *burning* the manure increases its effectiveness.

Taking these points in order, it may be said at once that the practice of transplanting seedlings from the bed to the field now prevails over most parts of India for the growth of the better classes of rice, especially where conditions of climate and rainfall are not favourable for broadcast sowings on the main field. The substitution, however, of the transplanting for the broadcast system has been one of gradual evolution, for more than 100 years ago we find that an observer, Dr. Howe, writing in admiration of the rice cultivation in the Thana district, now the centre of the ráb system, states that "the farmers have only lately introduced from Gujerát the system of transplanting from a seed-bed." As already noted, the practice of transplanting independently of ráb has now spread throughout India and it is not unknown in other parts of the world. Information supplied by agricultural authorities in Italy indicates that there the cost of the labour in-

volved in transplanting has been a bar to the practice, but it appears that experiments have been recently begun in this direction (1) although they are not as yet of a sufficiently precise character to be of practical service.

In Spain, where the conditions of climate and rainfall are not dissimilar to those of Italy, the practice has gained a considerable footing and may probably have been introduced by the Moors from Africa. An interesting paper on the subject by Dr. LUIGI ZERBINI (2) points out the advantages of the Spanish system, in which two successive crops of beans (one of *Phaseolus vulgaris* and one of *Vicia faba*) are grown on the seed-bed during the previous season. After the seed has been harvested, the plants are ploughed in as a green manure, thus forming a suitable tilth for the rice seedlings, which can be taken up therefrom with ease. Transplanting only costs about 7 per cent of the total outlay on cultivation and the system has the advantage of keeping the field comparatively free from weeds, so that the diminution in the cost of weeding is a material set-off against the expense of transplanting.

The fact that the transplanting system has found so much increasing favour in India and has been successfully introduced into Spain implies that the practice carries with it some advantages and points to the desirability of giving it a trial in rice growing regions where it is more or less unknown. These advantages are indicated in the article dealing with *Oryza sativa* in WATT'S *Dictionary of Economic Products of India*, p. 593 — "Healthy "seedlings are pushed forward in a manageable spot where care and attention as well as manure can be given to them, so that by the time the main "fields are ready they are in a forward condition and can thus get a start "which allows of a good harvest being fully matured by the season at "which the crop has to be reaped. By delaying sowing until the period when "the fields are ready, enough time is not left for the maturing of the grain "and the ripening of the crop". Other advantages mentioned by ZERBINI include :

1) additional crops from the same land ;
2) increased yield ;
3) possibility of making a selection of rice seedlings ;
4) less consumption of water.

Even in India, however, the farmers in some districts are said "to shrink from the transplanting system because of the cost and the heaviness of the labour" and no doubt experiment is everywhere required to ascertain how far the results of transplanting justify the cost.

The next point noted for consideration is the *manuring of the seed-bed*. In districts in India where the use of burnt manure does not prevail, it is not unusual to put on the seed-bed ordinary unburnt manure. Thus, in the district known as Shah-bandar, the Gazetteer tells us that "the nursery bed is well manured and ploughed several times, the seed

(1) See *B.* March 1915, No. 271.

(2) Dr. LUIGI ZERBINI, *Notizie e Considerazioni sulla Coltivazione del Riso in Ispagna.* Bologna, 1914.

" being dropped by a funnel during the last ploughing, and the seedlings " after 40 days growth are taken to the main fields also already ploughed " but *not* manured ". It has already been noted that the seed bed is green manured in Spain.

Another advantage of transplanting seems to be the possibility of economising in the use of manures, since applying the manures to the seed bed instead of to the field gives a greater efficiency for a given quantity of manure and incurs less expense in the application. This point would appear to be worthy of more attention in those countries in which rice is sown broadcast after manuring the field.

The third point for consideration is the *burning* of the manure. The practice of clay burning exists in many countries (1) as a means of ameliorating heavy clay soils, but apparently rather with a view of bringing the soil into a more workable condition than with regard to its manurial effect. The superiority of burnt manure is attributed by WALLACE to his belief that dung unduly exposed to heavy rain becomes sour and injurious to vegetation. Assuming that this may be the case, still recent investigations by Professor KNIGHT and Dr. MANN, of the Agricultural College, Poona, have tended to prove that there is an independent positive advantage in the heating of the soil on which ráb has been burnt. This indeed has become the most interesting question taken up in the later inquiries.

During 1904 to 1910 KNIGHT conducted experiments with a view to finding cheap and effective substitutes for ráb. In the course of his experiments he showed :

1) that the greater part of the beneficial effect of the ráb treatment might be attributed to the heating of the soil;

2) that the effect of the ashes of the ráb materials, though considerable, was of minor importance compared with that of the heating.

3) that results as good as those obtainable with the ráb treatment could be obtained by manuring with a considerable number of nitrogenous unburnt manures, the most effective at lowest cost being oil cake and particularly the cake of safflower (*Carthamus tinctorius*). The actual results obtained with the more important substitutes are given as follows (2):

In another series of trials comparing the ráb treatment with no manure, the yield of the ráb treated plots was as much as 125.9 per cent more than that of the unmanured plot.

In 1909-1912 MANN together with JOSHI and KANITKAR (3) investigated the several factors concerned in the ràb system, *viz*, the effect of heat on the chemical, physical and biological character of the soil; the effect o

(1) Prof. A. BRUTTINI, *Dizionario di Agricoltura*. Casa Editrice Vallardi, Milan.

(2) "Substitutes for Ráb". — *Bulletin No.* 63; *Department of Agriculture Bombay*, 191

(3) The "Ráb" System of Rice Cultivation in Western India. MANN, H. H., JOSH N. V., and KANITKAR, N. V. — *Memoirs of the Department of Agriculture in India*, Chemic Series, Vol. II, No. 3. February 1912.

Yield in lbs. per acre of field plots planted with seedlings from nurseries receiving:

	Burnt manures		Unburnt manures				
	Branches rab.	Cowdung rab. 44 240 lbs. per acre	Unburnt cowdung, half quantity used on rab plots.	Fish, 4800 lbs. per acre	Safflower cake, 3200 lbs. per acre	Ammonium sulphate, 600 lbs. per acre	Ammonium sulphate + superphosphate
Grain . . .	1 047	1 466	1 146	1 703	1 456	1 141	1 740
Straw . . .	1 278	1 645	1 188	2 099	1 627	1 105	1 542
	average of 8 field plots.	average of 9 field plots.	average of 9 field plots.	average of 4 plots.	average of 9 field plots.	1 plot only.	1 plot only.

the ash constituents on the plants; the effect of heat alone compared with that of the ash and of each with that of the complete ráb. Their results indicated that of the total increase of 182 per cent in dry weight of the seedlings at the time of transplantation, 44 per cent was due to the ashes and 56 per cent to heating. It was noted that the duration of the heating process does not exceed 1 ½ to 2 hours and that the soil temperature at half an inch below the surface does not exceed 110° C., and at 1 inch 75° to 80° C. The effect of heating the surface soil to various temperatures was then determined in pot cultures. It was found that the increase in the growth of the crop was proportional to the increase of temperature up to 125° C., and that the effect was greatest when the heating immediately preceded the growing of the crop. This effect passed off within three months after heating when the soil was kept dry before sowing, but disappeared in six weeks if the soil was wet, thus supporting the native belief that rain before sowing impairs the efficiency of the ráb treatment.

A detailed analysis of the heating effect in its various aspects was then made.

1) *Chemical Effects*: Analysis of the water-soluble constituents of the soil before and after heating showed a steady increase in the amounts of soluble minerals and organic matter with increase of temperature.

2) *Physical Effect*: The effect of heat on the soil texture was determined by sedimentation and percolation methods and the increase in permeability was found to be proportional to the increase of temperature. A similar increase in permeability brought about by the addition of gypsum was only able to effect an increase in yield of about ¼ the amount produced by heating the soil. Safflower cake, which had proved to be most effective as a ráb substitute, was found to have a greater flocculating power on a soil suspension than any other cake.

3) *Biological Effects*: With regard to the biological effects of heat on the soil, it was found that the activity of the aerobic organisms, as mea-

sured by the rate of absorption of oxygen, was very largely reduced, on heating to 125° C. for half an hour, but never wholly destroyed, and that after 7 weeks it greatly exceeded that in the unheated soils. Since the growth of the seedlings is greatest immediately after heating when the aerobic activity is lowest, it is concluded that the fertility of the soil is not dependent on the presence of large numbers of soil organisms during the growth of the plants.

Of the three effects due to heating, the chemical and physical effects were considered to be more important than the biological. This conclusion, classed as only provisional by the writers, may have to be modified in the light of recent progress in soil biology and the partial sterilisation of soils; and it is possible therefore that the heating effect in the ráb system is capable of more complete explanation on biological grounds. Thus RUSSELL and PETHERBRIDGE (1) have shown that temperatures between 55° and 100° C. cause considerable changes in the bacterial flora and protozoa of the soil, resulting in a great and rapid *increase in ammonification* and promoting a greater development of the fibrous roots of the plants. In this connection it is interesting to note that KELLEY (2) in Hawaii and MENOZZI (3) in Italy have shown that nitrogen in the form of *ammonia* is the most effective manure for rice, and that greater yields obtained by applying it before planting than at intervals during the growth of the crop. On this view the heating effect of the ráb system would seem to produce ideal conditions in the seed-bed for the growth of the seedlings, as it causes the temporary increase in ammonification of the soil at the most favorable period in the development of the rice plant.

On the question of the wastefulness of the present system of using forest material as ráb, the following remarks by the writers of the Pusa Memoir are interesting : " The principal conclusion we have so far been " able to reach is that no method not involving a greater actual out-of- " pocket expenditure seems likely to yield the results which are " obtained with the combined application of heat and of wood ashes to " the soil which is given in the ráb process.

" This being the case, it would seem that attention should be largely " concentrated on obtaining the application of these by a less wasteful " method than the ordinary burning of ráb. Our experiments clearly " indicate that if the heating effect is obtained, combined with the applica- " tion of wood ashes, it matters little how it is brought about. No one " who has watched the actual practice in vogue can doubt its wasteful- " ness of both heat and fuel, and we feel confident that the quantity of fuel " (i. e. cowdung, branches and other materials) could be reduced to, at most,

(1) *The Journal of Agricultural Science*, Vol. V, part I, Cambridge 1912; and *B* Jan. 1913, No. 14.

(2) " The Assimilation of Nitrogen by Rice ". — *Hawaii Agricultural Experiment Station Bulletin*, No. 24. Washington, 1911. — Also *B*. Aug.-Sept.-Oct. 1911, No. 2513.

(3) " Les Engrais dans la Culture du Riz, " by Prof. ANGELO MENOZZI: paper read at the International Rice Congress, Vercelli, 1912.

" one quarter of the amount at present used if, instead of its being spread " over the surface of the soil, the latter could be burnt in heaps. The area " to be burnt is small and the soil to be heated consists only of the sur- " face layer to one inch deep. Thus to plant one acre of rice would require " the heaping up and burning of a comparatively small amount of soil.

" It would not seem difficult to devise a reasonable method requiring " far less fuel and trouble in collecting fuel than is submitted to now. That " soil, especially a heavy sticky, clayey soil like that in these regions, can " be so burnt in heaps is proved by the former common practice of so " burning it in Europe, and by the practice in the fen districts of Eng- " land at the present day. And in this direction the solving of the diffi- " culties both of the cultivators and of those who are anxious to prevent " the damage to the forests and trees in the rice tracts of the Deccan and " Konkan, seems most probably to lie ".

[I have to acknowledge the great assistance given by Mr. N. W. Barritt, B. A., of the Institute staff, in the preparation of this article. — E. C. Buck.]

Studies on the Cotton Plant in Egypt.

by

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and to the Egyptian Department of Agriculture.

Having been requested to prepare an account of my studies of Egyptian Cotton for this Bulletin, I propose using the opportunity in a way which may be of use to fellow-investigators, by pointing out in the space at my disposal the inter-relation between my various publications on this subject. Such a proceeding is admittedly unusual, but the circumstances render it advisable, and almost necessary. A list of these publications, with reference numbers, is given at the end of the present article.

The circumstances may best be illustrated through a kindly criticism made by Mr. Bateson when reviewing " The Cotton Plant in Egypt ". He objected that I had not persisted further in the various lines of research opened up, once a solution was in sight, and he demurred to the use of the Cotton Plant as an excuse for a book dealing with such a variety of topics. In spite of the validity of these criticisms, from one point of view, they scarcely hold good from another one. The book in question was written at a time when it had become imperative to co-ordinate the various researches, as they were liable to end at any time through external causes ; on the other hand it was not then possible, scientifically, to assert that they would all converge to generalizations which would justify the work expended upon them.

The great diversity of the inter-related facts which have to be handled is a difficulty inherent in the application of scientific treatment to economic problems. Perhaps this diversity and difficulty is exceptionally great in the case of cotton, owing to the wide gap which separates the consumer from the producer. An inevitable drift towards multiplicity of investigations thus became apparent at a very early stage in my enquiries; the alternatives were, either to abandon scientific objectives, which was most undesirable; or else to divest the work of any direct utilitarian purpose, which was obviously impossible. This drift was accelerated by economic and political events concurrent with my investigations, by which my attention was perforce directed to more aspects of the matter. Lastly, it was not until 1912, after seven years, that any adequate provision could be made for the application of results, and for the conduct of the researches on a sufficient scale; even then they were hampered by their own development, which had to be effected at express speed. Thus, a certain pure strain type being needed in February, 1912, over a ton of seed was prepared by November, 1913; the type was found, isolated, purified; tested for agricultural properties and gametic composition, and propagated from a single plant, all within two seasons, by carrying on all the operations simultaneously.

The work as a whole thus consisted of a series of flanking-attacks on the problems implicated. As soon as the solution of any one problem was in sight, the circumstances and limitations of the work made it usually both easier and quicker to follow out the side issue which was tending in the same direction from another phylum of research. In the accompanying diagram I have indicated the genetic connection between the numerous, and apparently disconnected, publications.

We will first examine the major conclusions reached, which would seem to be somewhat as follows, though each one embodies a number of minor conclusions, especially in the matter of technique, both scientific and agricultural.

Farming. — A) The old-established conventional methods of cotton cultivation practised by the Egyptian native are the best possible for the given circumstances.

B) By simple methods the crop can be "sampled" at a number of Observation Stations, and Crop Records prepared in the form of Curves of Plant Development, providing an exact and non-subjective Crop Reporting system which is also capable of being used for Crop Forecasting on a scientific basis.

C) The deterioration of the yield of cotton per acre in Egypt from 1898 to 1912, was almost entirely due to the rise of the water-table, through the action and inaction both of individuals and of the State. This effect acts in part directly by decreasing the depth of soil available, but mainly by bringing the water-table into contact with the roots sooner, when it rises as a direct and indirect consequence of the rise of the Nile Flood.

E) The deterioration of "quality" within the same period, especially of the Afifi variety, has been caused mainly by increasing impurity through admixture and natural crossing.

Spinning. — F) The best cotton is obtained from pure strains, other things being equal.

G) The best samples of fine cottons, in the ultimate and absolute test of actual spinning, are those which contain the smallest percentage of abnormally strong hairs.

H) The opinions of experts based on "handling" of commercial lint, are no guide to the real spinning value and properties of pure strain lint.

Plant Physiology. — J) The plant is the slave of the Limiting Factor of the environment, above or below ground, at any given moment, and in itself constitutes a perfect recorder of such factors.

K) But, in interpreting such plant-records, due regard must be paid to the Pre-Determination of characteristics. An effect may not be obvious until many weeks after it has been determined.

L) The direct response of growth-processes to the limiting factor is often masked in individual buds and organs by pre-determined Depressant Factors, possibly of an auto-toxic nature.

Plant Breeding. — M) No system of seed-supply for cotton can be entirely successful unless it provides against contamination of the stock by natural crossing, presumably through seed-renewal. This provision can be most cheaply and safely effected by building bee-proof cages of brass wire gauze over the initial propagation plots.

K) Similarly, deterioration through natural selection can only be avoided by the use of pure strains.

L) The propagation of renewal-seed has been effected at the rate of one metric ton of seed alone from a single seed in three generations. Five tons from one seed in the same period is easily practicable.

Genetics. — M) Mendel's Law of gametic segregation applies to most or all the characteristics of cotton plants, qualitative or quantitative, even in Ægypto-Upland crosses, but with many extraneous complications, even in simple crosses.

N) These complications include gametic Re-Duplication in more than one ratio, and the deformation of measureable characters by Autogenous Fluctuation.

Irrigation. — O) Cotton flourishes best on soil which is from two to three metres in depth. Drains should keep the water-table to this level.

P) In no soil should the water-table be allowed to rise, even 20 cm., for more than a day, once the roots have reached it.

Q) The crop actually uses as much as 50 metric tons of water per feddan (of 4 200 square metres) per day in the late summer, at a time when the available water is the main limiting factor of growth.

R) If the water-table be kept down, the injury resulting from over-watering in late summer and autumn is merely due to the washing away of nutrient soil-salts. A crop on rich soil can stand over-watering.

S) Skilful deprivation of water hastens the maturity of the crop by a few days, but only at the expense of lint quality and yield.

***

The conclusions embody answers to most of the economic questions raised during the author's work in Egypt. They represent a definite stage of generalization, and from them it should be possible to work back to particular details quickly and easily.

They were reached along two main phyla of research, Physiology and Genetics. The investigations in Genetics began with a cytological examination of the flower, which at once led off to the development of the lint, only to be arrested by experimental difficulties, and it was not until several years later that resumption of the lint-studies was made possible by linking up with the physiological work. The Mendelian work proper first produced the discovery of natural crossing, which led to appreciation of the reasons for varietal deterioration, and so to the organization of a seed-supply system. The concomitant isolation of pure strains gave material for the study of fluctuation, thus linking up Genetics with Physiology, and it also formed the basis for my seed-supply arrangements, which in their turn threw unexpected light on the spinning properties of fine cotton.

The main phylum of Mendelian studies had developed to the stage at which it showed the great complexity of the inheritance, exceeding that which has been observed by some other workers with less elaborate data, when it was practically arrested by pressure of work on the organization of the seed-supply system. In this, however, it was of immediate value in providing methods for the isolation of pure strains from natural hybrids.

A cross-connection resulted from devising statistical methods for the study of hybrid populations, further developed on pure strains, and thence (through variety-testing by small amounts of seed grown in Observation Rows) these methods linked up with the study of the field crop. The field crop thus came to be regarded as an average plant, and therefore amenable to purely physiological interpretation.

The physiological investigations began on the "sore-shin" fungus which was destroying pedigree seedlings. Elucidation of the biology of this minor pest led to study of growth in relation to temperature, and to the conception of auto-toxins, both results finding immediate application in studying the growth of the plant during the first half of the season, and ultimately in dealing with the effects of water-shortage, sowing-date, and soil temperature. In the course of this study of the field crop, as a form of specialised ecology, certain enquiries were necessary in order to evaluate the environmental conditions, both above ground and below. These were accelerated by the invention of the Stomatograph, which demonstrated the severe conditions of water-strain under which the plant exists, and led to the valuable conception of root-interference.

Meanwhile the Water-table Hypothesis had been adopted, explaining yield-deterioration by root-asphyxiation, and while it gave these physiological enquiries a direct applicability, it emphasised our ignorance of the crop as well as of the water-table. Subsequent investigations of the latter were conducted by fellow-workers, though the writer was able, by a stroke of

mere luck, to provide the final proof. The crop-studies became urgent with the development of the seed-supply system, if only in the need for establishing constants as to the correct sowing-time and spacing for the propagation of seed with the minimum of risk at the maximum rate. Two very detailed investigations on these points were conducted by the Method of Plant Development Curves, to be followed by a similar study of manurial treatments, which was never effected, and linked with other workers' studies of the water-supply effects, which had given inexplicable results. Supplemented by data from previous years the co-ordination of all these gave a fairly complete summary of the causes which can affect the crop, and of the manner of their action, both on the final yield and on the quality of the product.

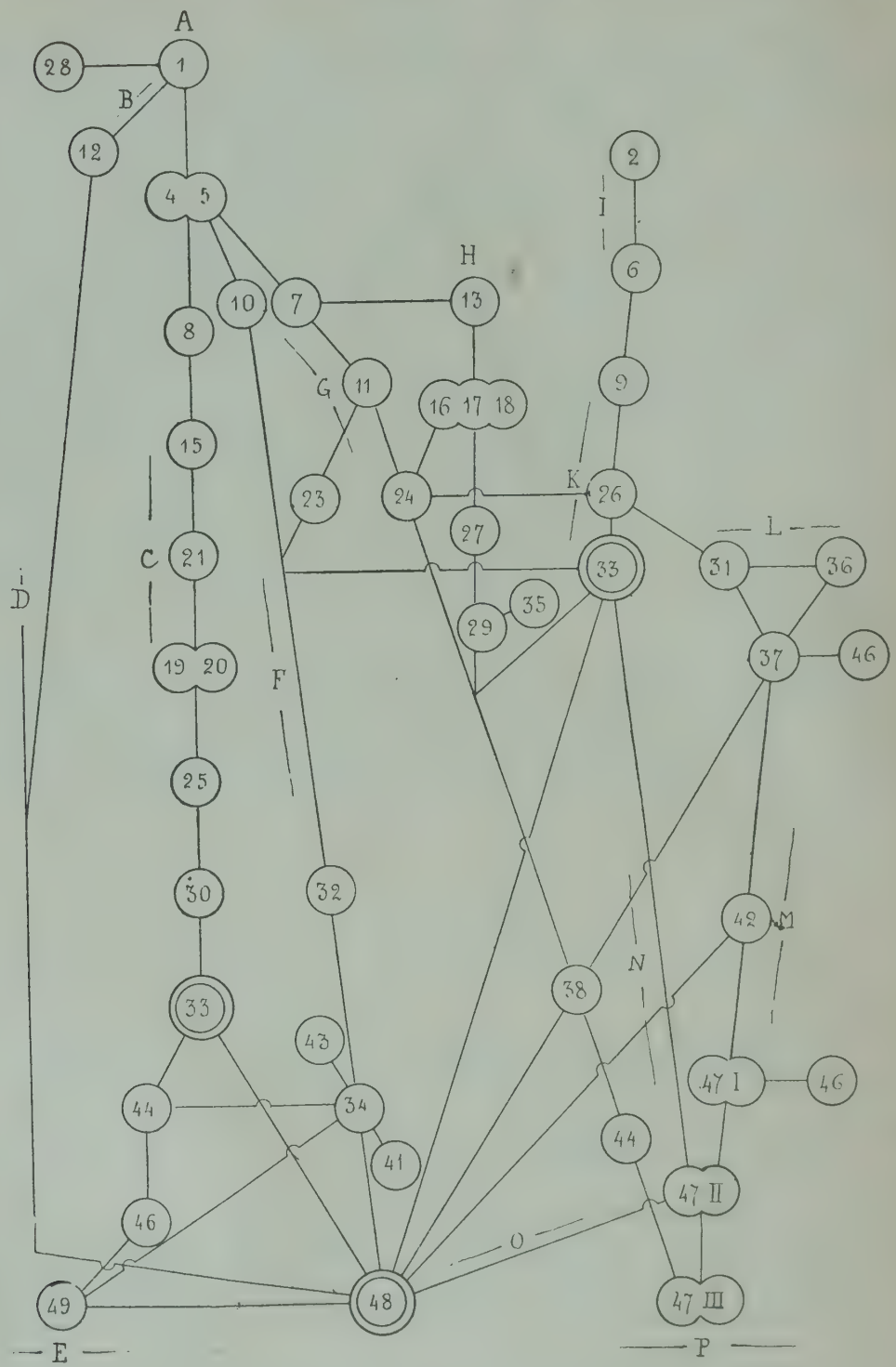
Although I have been able since my resignation to publish data and results with fewer restrictions, there still remains a considerable quantity of statistical material to be treated. The accumulation of this material was due to the training of ordinary native labourers as " plant observers ", employing them to do skilled work within a limited sphere. This, in itself, was an experimental result of some significance. Most of the original Mendelian data are still unpublished and will probably remain so, being scarcely sufficiently conclusive.

The principal indication afforded by these enquiries, regarding the direction of further research, is rather scientific than economic. They all tend to show that our knowledge of the physiology of Growth is capable of very rapid extension. The result of such extended knowledge of Growth might conceivably be to restore the balance of biology with engineering in modern civilization.

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Schema showing interrelations of Publications enumerated in List.



LEGEND.

A. — Genetics.
B. — Cytology.
C. — Mendels' law.
D. — Official reports on Lancashire.
E. — Spinning.
F. — Pure strains.
G. — Crop behaviour.
H. — Water-table.
I. — Fungus.
K. — Physiology.
L. — Environnment.
M. — Crop records.
N. — Growth.
O. — Water supply.
P. — Growing.

15. — " Studies of Egyptian Cotton ". — *Yr. Bk. K. A. S.*, 1909, pp. 180. (Mendelian Cotton Breeding ; Experimental Results from a single Cross ; The Cotton Crop of Egypt).
16. — " A Summary of present information concernig the effect of Sub-soil water on the Cotton Crop ". — *Supplement Yr. Bk. K. A. S.*, 1909.
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37. — " Movements of Soil Water in an Egyptian Cotton Field ". — *Jour. Agric. Sci.*, 1913.
38. — " A study of Some Water-Tables at Giza ". — *Cairo Sci. Jour.*, 1914.
39. — " The Sudan and Cotton ". — *The Near East* (three articles), 1914.
40. — " Leaf-fall as a factor in Soil Deterioration ".
41. — " Specific Salinity in the Cell-sap of Pure Strains ".
42. — " The Pre-Determination of Fluctuating Characteristics ". Preliminary Notes ; *Proceedings Cambridge Philosophical Society*, 1914.
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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY

779 – **Reorganisation of the Meteorological Service in Brazil.** — I. *Diario Official, Estados Unidos do Brasil*, Year LVI, No. 61. Rio de Janeiro, March 14, 1915. — II. *Bulletin Officiel du Bureau des Renseignements au Brésil à Paris*, No. 33, pp. 12-13. Paris, June 15, 1915.

Decree No. 11508, of March 4,1915, for the reorganisation of the Direction of Meteorology and Astronomy in Brazil, contains the following clauses:

The scope of the Direction of Meteorology and Astronomy includes:

1) Development of the knowledge of general climatology in Brazil, by publishing quarterly and yearly bulletins as well as maps and diagrams giving summaries of the observations made at the National Meteorological Stations.

2) Study of rainfall and droughts and the course of the floods and low-waters due to them; carrying out investigations for the solution of the question of water-supply for the dry regions.

3) Organisation of weather forecasts and supplying to seamen and farmers warnings based on observations and telegrams, considering the course of depressions, cold-waves, storms, etc.

4) Fixing of the different types of weather in the zones of the country having distinct meteorological characteristics.

5) Drawing up and publishing of the daily weather chart, as well as of the forecasts for seamen and farmers.

6) Publication of works on its own subject, as well as a Yearbook containing useful data and information referring to astronomy, meteorology, physics, chemistry, geography, statistics, etc.

The following institutions will be placed under the Direction of Meteorology and Astronomy:

A National Observatory. — Regional Observatories (First-class Stations) equal in number to the Agricultural Inspectorates. — A Radiotelegraphic Time Station on the island of Fer-

nando de Noronha. — Magnetic and Geophysics Stations. — Second-class Stations. — Third-class Stations. — Pluviometric Stations.

The National Observatory will form the seat of the Direction. This observatory undertakes the publication of the meteorological and astronomical observations collected by the Regional Observatories or subordinate Stations.

The Regional Observatories undertake the organisation and collecting of the observations made within their respective agricultural districts. In particular their work includes:

1) Taking of all observations required by the International Code for first-class stations.

2) Collecting together all the forecast telegrams from the district; from these data, with those furnished by the National Observatory, the director of each Regional Observatory will draw up a weather chart and make his forecast, which will then be telegraphed to the National Observatory.

3) Sending the weather warnings to the persons requiring them.

4) Collecting all the observations made and registered by the secondary Stations and furnishing a monthly report of all the Stations of the district to the National Observatory.

The Second-class and Third-class Stations undertake regular observation of the ordinary weather elements: barometric pressure, temperature and humidity of the air, wind, clouds, etc. Several observations must be made during each day.

The Pluviometric Stations undertake chiefly measurement of rainfall.

In the capitals of States containing no Regional Observatory, special Second-class Stations will be set up. The Union will make grants to the States which maintain a meteorological service. These grants will consist in free provision of the instruments required and 50 per cent of the salaries of the staff.

780 – **Effect on Soil Moisture of Changes in the Surface Tension of the Soil Solution brought about by the Addition of Soluble Salts.** — KARRAKER, P. E. (Assistant Professor of Soils, Kentucky State University), in *Journal of Agricultural Research*, Vol. IV, No. 2, pp. 187-192. Washington, D. C., May 1915.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

The writer first compares the specific gravity, electrical resistance, surface tension and viscosity of various salt solutions, manure extract and soil percolates with pure water. Salts generally increase slightly the physical properties of the solution, whilst soil percolates and manure extract, especially, lower the surface tension and increase the viscosity. He considers WHITNEY'S observations on the increased surface tensions of salt solutions to be exaggerated for solutions equivalent in concentration to the soil solution.

The effect of the above solutions on the water-retaining power of sandy loam and clay loam soils was determined by placing the soils after saturation with the various solutions in closed columns resting on an air-dried sandy loam soil. The soils were in direct capillary contact with the dry soil underneath and the changes in water content of the soils were determined at intervals throughout the period March to July.

It was found that the effect of single salts on the surface tension of the soil solution was too small to cause any measurable changes in the water-retaining capacity of the soils. In the case of the manure extract, however, there was a marked increase in the moisture movement rather than a decrease which would have been expected from the decreased surface tension. It is therefore concluded that the effect of the solution on the physical texture of the soil is more important than the surface-tension effects. The changes produced in the physical texture of the soils were compared by determination of the resistance to a crushing force of columns of soil 2 ½ inches in length. A close correlation was found between the resistance of the soil and the change in moisture content of the various columns of soil.

From these results it is concluded that changes in the surface tension of the soil solution arising from the application of fertiliser salts are of no importance in affecting the moisture condition of the soil.

781 – **The Origin of the Humin formed by the Acid Hydrolysis of Proteins** (1). — GORNER, R. A., and MORRIS, J. B. (College of Agriculture, University of Minnesota), in *The Journal of the American Chemical Society*, Vol. XXXVII, No. 6, pp. 1630-1636. Easton, Pa., June 1915.

It is well known that when proteins are hydrolysed by boiling with acids, a blackening of the solution occurs and that black insoluble particles of humin separate from solution. OSBORNE'S statement that zein (the protein of maize) yields almost no humin and that tryptophane is not present led to an investigation of the possible relationship between tryptophane and humin.

It was found that when zein was hydrolysed alone the solution did not become intensely black, but the addition of tryptophane resulted in a rapid development of an intense black colour. The hydrolysis of tryptophane alone didnot result in the formation of a black colour, whilst the addition of a carbohydrate such as dextrose enabled practically 90 per cent of the tryptophane nitrogen to be recovered as humin. No humin could be obtained by the hydrolysis of histidine in the presence of carbohydrates.

It is therefore concluded that humin nitrogen represents a portion of the tryptophane nitrogen and that if sufficient carbohydrate be present the humin nitrogen can be regarded as an almost quantitative determination of the tryptophane nitrogen.

Since boiling carbohydrates with mineral acids results in the formation of small amounts of furfural it seems highly probable that the reaction involved in humin formation is a condensation of tryptophane with an aldehyde.

782 – **Effect of Certain Organic Substances of the Soil on Wheat.** — UPSON, F. W., and POWELL, A. R. (University of Nebraska Experiment Station, Lincoln), in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 5, pp. 420-422. Easton, Pa., May 1915.

Of recent years there have been isolated from soils, particularly in the United States, several organic compounds whose toxic effects on wheat

(1) See also *B.* May 1915, No. 459. (*Ed.*).

and maize (except in two cases) have been observed for a comparatively short period in water cultures. The writers have carried out experiments in pot cultures with vanillin, salicylic aldehyde, coumarin, quinone and dihydroxystearic acid.

From these experiments it appears that the effects of vanillin and salicylic aldehyde on wheat in soil culture are essentially different from their effects in water culture. Thus, whilst under the latter conditions 500 parts per million of vanillin and 50 parts per million of salicylic aldehyde prove fatal, in soil cultures 1000 parts and 500 parts per million respectively are only slightly or not at all toxic. In the case of salicylic aldehyde similar result were obtained in the case of maize, but in another soil different results were obtained with wheat. Quinone below 500 parts per million has a beneficial action on wheat in soil culture, whilst coumarin and dihydroxystearic acid have a notably more toxic action than vanillin, but the action is always different from that observed in water cultures.

The writers consider it necessary to conduct more extensive experiments than those here reported.

783 - **The Loss of Nitrogen and Organic Matter in Cultivated Soils in Kansas and their Productivity**. — SVANSON, C. O. (Kansas State Agricultural College, Manhattan), in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 6, pp. 529-532. Easton, Pa., June 1915.

The cultivated soils of Kansas generally show a decreasing productivity in spite of the use of better seeds and improved tillage. The analysis of cultivated and virgin soils from seven counties shows that the carbon and nitrogen have disappeared to the greatest extent from the cultivated soils, and that the loss amounts to from 1200 to 1800 lbs. of nitrogen and from 32 400 to 49 600 lbs. of organic matter per acre in the first 7 inches of soil, the different localities showing losses of from 22.6 to 43.5 per cent of the nitrogen and from 23.3 to 51.3 per cent of the organic matter.

Comparing the ratio nitrogen : carbon in vegetable matter and in the organic matter of the soil, it is found that 150 tons of native vegetation are required to produce the 50 tons per acre of soil organic matter contained in most of the native prairie soils of Kansas.

Thus, the loss of one-third of the organic matter of the soil, with its corresponding amount of nitrogen, represents the most important cause of the above-mentioned diminution in crop-producing power of these cultivated soils.

784 - **Ammonia-Soluble Inorganic Soil Colloids**. — FRAPS, G. S. — *Texas Agricultural Experiment Station, Bulletin* No. 165, 8 pp. Austin, Texas, 1914.

Twenty-six soils representing a series of types ranging from sands to clays were digested with $^{N}/_{5}$ hydrochloric acid for 24 hours and then with 4 per cent ammonia for an equal length of time. The ammonia extract was filtered repeatedly through the soil and filter paper till a perfectly clear liquid was obtained. This filtrate, containing the soluble inorganic colloids, was then analysed for silica, iron and alumina. Grouping the

soils into four divisions according to their total soluble inorganic colloid content, the following average figures were obtained:

Percentage soluble inorganic colloidal matter in soils.

Percentage of total inorganic colloids present	SiO_2	Fe_2O_3	Al_2O_3	Total colloid precipitate
I. 0 to 0.05	0.015	0.004	0.002	0.028
II. 0.05 to 0.1	0.039	0.009	0.011	0.072
III. 0.1 to 0.2	0.069	0.015	0.041	0.135
IV. 0.2 to 0.6	0.137	0.041	0.113	0.299

As the total colloid precipitate increases, the proportion of alumina in the precipitate rises considerably while the proportion of iron remains practically stationary and the proportion of silica decreases slightly. The molecular ratio of the constituents in the different groups is calculated as follows:

Group I	12 SiO_2	2 Fe_2O_3	Al_2O_3
» II	11 SiO_2	2 Fe_2O_3	2 Al_2O_3
» III	12 SiO_2	Fe_2O_3	4 Al_2O_3
» IV	10 SiO_2	Fe_2O_3	4 Al_2O_3

785 - **Lithium in Soils.** — STEINKŒNIG, L. A. (Bureau of Soils, U. S. Department of Agriculture, Washington), in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 5, pp. 425-426. Easton, Pa., May 1915.

Since lithium is of widespread occurrence in rocks it is natural to expect to find it in soils and in the plants growing in such soils.

Its occurrence has already been recorded in many plants and soils, but no satisfactory quantitative determinations are available. The writer has effected these by separation of the lithium with sodium, and then determining the lithium by means of the spectroscope. Thus, in 19 soils from six different regions comprising various types from sands to clays, lithium was found to occur to an extent of from 0.001 to 0.008 per cent, and from 0.002 to 0.007 per cent in the subsoil, and often in greater amounts than rubidium (Cf. *U. S. Department of Agriculture, Bureau of Soils, Bulletin* 112, 1914). The percentage of lithium does not appear to be associated with that of any other element. It is almost the same in the subsoil as in the surface soil, but with a slight tendency to increase in the subsoil. In certain loam soils the percentage may reach 0.010 per cent.

786 - **Biochemical Reduction Processes in the Soil.** — VAN WOLZOGEN KÜHR, C. A. H. (Proefstation voor de Java-Suikerindustrie), in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXIII, Part 13, pp. 501-511. Soerabaia, March 1915.

The anaerobic activity of micro-organisms gives rise to reduction processes in the soil, producing organic compounds which may be injurious

to the roots of cultivated plants. If, however, there is gypsum in contact with readily oxidisable organic substances, the organism *Microspira desulfuricans*, Beyerinck, reduces the sulphur of the gypsum to sulphuretted hydrogen, which nearly always combines immediately with iron, forming insoluble sulphide of iron; this imparts a dark colour to many soils, without injuring the crops.

The production of ferrous compounds is very probably a result of the activity of micro-organisms. Such ferrous compounds act as reducers; thus it has been observed that in parts of plantations where the sugarcane shows the poorest development there is the highest percentage both of ferrous compunds and of organic reducing substances.

When the soil analyses show the existence of ferrous compounds, it can therefore be concluded that the reduction processes taking place in these soils are especially intense. In order to determine the ferrous reaction the use of freshly prepared potassium ferricyanide is recommended.

787 - **Studies on Ammonification in Soils by Pure Cultures.** — LIPMAN, C. B., and BURGESS, P. S., in *University of California Publications in Agricultural Sciences*, Vol I. No, 7, pp. 141-172. Berkeley, California, 1914.

Various species of ammonia-producing organisms were studied with regard to their physiological efficiency. Pure cultures were innoculated into a medium consisting of sterilised soil mixed with different organic fertilisers and the intensity of the fermentation was observed. The bacteria in question were the following: *B. mesentericus vulgatus, Ps. putida, B. vulgatus, B. megatherium, B. mycoides, B. subtilis, B. tumescens, Sarcina lutea, B. proteus vulgaris B. icteroides, B. ramosus, Streptothrix*, sp., *Ps. fluorescens, B. vulgaris*, and *Mic. tetragenus*. The experimental media represented various combinations between three types of soil — sandy, clay-loam and clay — and the different organic manures used, *viz.* dried blood, tankage, cotton seed meal, sheep and goat manure, peptone, fish guano and bat guano.

The results were very irregular. It was found that an organism's power of ammonification varied not only with the fertiliser used, but also with the nature of the soil in which the reaction took place. Nor could the intensity of the fermentation be predicted with any measure of accuracy. It may be said in a general way that the organisms fell into two approximately equal categories, one of which represented a group of more efficient ammonifiers than the other. Amongst the members of this category, *B. tumescens, B. mycoides* and *Sarcina lutea* stood out as specially active under suitable circumstances.

The experiments are being continued, and will subsequently include nitrification tests in addition to the ammonification tests.

788 - **Efficiency of Water for Crop Production**. — ASHLOCK, J. L., in *The Country Gentleman*, Vol. LXXX, No. 19, p. 850. Philadelphia, May 8, 1915.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

At the Agricultural Experiment Station at Washington some investigations, planned by C. C. THOM, have recently been carried out with the object of throwing new light on the problem of whether the amount of

Efficiency of irrigation water.

Zone	Rainfall, inches	Irrigation water, acre-inches	Total available water, acre-inches	Total crop, bushels per acre	Bushels per acre-inch
Maize					
1st	7	2	9	66	7.33
	7	4	11	74	6.72
2nd	7	6	13	77	5.92
	7	8	15	77	5.13
3rd	7	10	17	74	4.35
	7	12	19	67	3.52
	7	24	31	60	1.93
Alfalfa					
1st	7	10	17	13 000	764
	7	12	19	14 000	736
	7	14	21	15 500	738
2nd	7	22	29	15 650	539
3rd	7	26	33	15 150	459
Potatoes					
1st	7	0	7	87	12.43
	7	3	10	165	16.50
2nd	7	7	14	177	12.64
	7	10	17	217	12.76
	7	13	20	233	11.65
	7	16	23	241	10.47
3rd	7	19	26	very marked lowering with yield	

irrigation water generally deemed necessary and used for agricultural production can be decreased without decreasing the profits of the farm.

The studies plainly reveal three zones of efficiency in irrigation. In the first a fairly light application of water produced rapid and profitable increases in the crops. In the second a heavier application of water produced a small increase of crop — so small that it scarcely paid for the water and the extra labour. In the third a still heavier irrigation was followed by a rapid decrease of the crop.

In the above tables the first column indicates the zone, the second

the rainfall over the experiment field, the third the amount of irrigation water applied to the various lots, the fourth the total amount of water available for the crops, the fifth the total crop, and the sixth the amount of crop per acre-inch of water.

It will thus be seen that in the case of maize, irrigation water was used with maximum efficiency when six to eight inches was added to the rainfall, which in all the cases above cited was seven inches. In the case of alfalfa, irrigation water attained its maximum efficiency when fourteen acre-inches were added to the rain. In the case of potatoes, ten inches of irrigation added to the rain gave the maximum efficiency.

MANURES AND MANURING

789 - **The Cultivation of Seaweed in Ireland and its use as Manure.** — PETHYBRIDGE, GEORGE H., in *The Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XV, No. 3, pp. 546-549, 5 plates. Dublin, April 1915.

The value of seaweed for agricultural and industrial purposes, as well as, to a more limited extent, a food-stuff, has long been appreciated in Ireland.

There are two classes of weeds which are made use of in a large way. The first contains those belonging mainly to the genus *Laminaria*, which grow in the deeper waters off rocky portions of the coast. During stormy weather these plants are washed ashore; they are then collected, stacked to dry and burned to produce "kelp". The second class consists of those species, mainly of the genus *Fucus* and its allies, whose habitat is between tide-marks. A portion of these is also washed ashore in stormy weather, but the greater part is cut directly. Such weed is used almost exclusively for manurial purposes.

The seaweeds useful as manure all grow attached to rocks or stones and are consequently absent from sandy and estuarine areas. By the "cultivation of seaweed", therefore, is meant the provision of suitable anchorages, generally large stones, between tide-marks, in localities where rocks and stones are naturally absent. There are several places round the coast of Ireland where seaweed is cultivated in this way and there are probably a number of localities to which this cultivation might be extended with advantage.

At Achill Sound in Co. Mayo large stones are collected from the shore, taken out in boats at high tide, thrown overboard and subsequently, at low-water, arranged in more or less regular lines forming rectangular beds or fields on the muddy or sandy bottom. The crop of weed is cut once in two years. In course of time the stones tend to sink; when this happens they are raised by spades and crowbars without being turned over. The most abundant species is *Fucus vesiculosus* ("bladder-wrack") and next comes *Ascophyllum nodosum*, which grows well in somewhat deeper water. The seaweed gathered is used chiefly as a manure for potatoes, being spread in its fresh condition on the ridges and allowed to lie for a few days before being turned in.

At Mill Bay, Co. Down, there occurs on *Fucus vesiculosus*, the species most valued by farmers, and to a still greater extent on *Ascophyllum nodosum*, an epiphytic red seaweed *Polysiphonia fastigiata*. This is regarded

by the farmers as an undesirable "weed", and after each cut the stones are turned over in order to prevent its growth.

The seaweed produced is nearly always used by the farmer owning the bed, being but rarely sold. In 1913 the average price "on foot" per ton was about fifteen to sixteen shillings. In the same year a bed measuring thirty-eight squares perches (Irish) (1) was sold for over £ 40.

In addition to the seaweeds used as manure and for the production of "kelp", others, such as "Carragheen moss" (*Chondrus crispus* and *Gigartina mamillosa*), "sloke" and "dillisk" (*Porphyra vulgaris* and *P. laciniata*), find employment in textile industries and for food purposes. These species, however, are at present merely collected and not "cultivated".

The "sea-lettuce" (*Ulva latissima*), which is abundant along several portions of the coast, gives rise on decay to volatile products having a very objectionable odour. The suggestion has been made of replacing this weed by bladder-wrack and similar species by the deposition of large stones; where this is impossible the *Ulva* itself might be "cultivated", possibly on twigs or brushwood, or at any rate its growth *controlled* in such a manner that the weed could be gathered when full grown and before decay set in. Fresh *Ulva* is very rich in nitrogen; it should therefore be possible to convert it by some chemical method into a form capable of serving as the basis of a valuable chemical manure.

790 - **Bat Guano in the Caves of Metapán, San Salvador.** — CHOUSSY, FÉLIX, in *Revista agrícola Salvadoreña*, Year III, No. 3, pp. 77-78. San Salvador, March 1915.

The writer records the occurrence of large deposits of bat guano in the caves in the neighbourhood of Metapán, especially in that called "Cueva del Aguilucho", which contains some hundreds of tons. This guano is pure, of relatively recent origin, practically undecomposed, and of good quality.

791 - **Deposits of Guano and Phosphates in Colombia.** — *Fertilisers and Feeding Stuffs Press*, Vol 7, No. 27, p. 273. London, July 3, 1915.

The Ministry of Public Works of the Republic of Colombia has granted the necessary concession for working deposits of guano and mineral phosphate existing in the Department of Magdalena (Northern Colombia). The concession is burdened by a due of 15 per cent on the raw product, payable in money or in kind; it lasts for 30 years, with a delay of one year to begin working the deposits.

792 - **The Fertiliser Value of Filter-Press Cake from Sugar Factories.** — CROSS, W. E. (Chemist, Tucuman Agricultural Experiment Station), in *The International Sugar Journal*, Vol. XVII, No. 198, pp. 267-271. London, June 1915.

The composition of the filter-press cake from sugar factories varies according to the method of clarification. The amount of phosphoric acid varies from 3 to 7 per cent and the nitrogen from 1.8 to 2.7 per cent. Its manurial value in America is therefore from $ 7.31 to $ 10.0 per ton. Most of the phosphoric acid is citric-soluble so that the real ma-

(1) About three-eighths of an acre. (*Ed.*).

nurial value is higher than the above figures. A factory grinding 2000 tons of cane per day will produce about 16 tons of air-dry filter-press cake worth about $ 160.

This cake is therefore of considerable value and by returning it to the plantation, the crop of sugar is obtained without appreciable loss of fertility from the soil.

Manurial experiments in Hawaii and Java have shown the value of this cake as a manure and similar experiments are being planned at Tucumán.

793 – **Sewage Sludge as Manure.** — *The Journal of the Board of Agriculture*, Vol. XXII, No. 3, pp. 235-238. London, June 1915.

The situation of the use of sewage sludge as manure in England is reviewed [Cf. *Royal Commission on Sewage Disposal. Fifth Report* (Cd. 4278); *Appendix VIII to Fifth Report* (Cd. 4286); *Appendix to Ninth Report* (Cd. 7820)].

Small amounts of human excreta are of course applied to the land as such, with or without some preliminary treatment, but the fact that a water-borne system of sanitation is almost everywhere prevalent in Great Britain necessitates the use in some way of sewage as manure if the valuable manurial ingredients of human excreta are not to be allowed to go to waste. Sewage has found application on sewage farms for crops such as cabbages, turnips, mangolds and grass. Its employment in this way, however, has been limited, since large volumes of liquid have to be dealt with, of which even the best adapted soils can absorb only relatively small quantities, so that considerable areas of land are necessary; and sewage farming in general does not seem to have been a great commercial success.

A further method of utilising the manurial ingredients of sewage, to which much attention has been given, is the application of sewage "sludge" to the land. At the sewage works where the sewage is treated for purification the coarser solids are first removed; after this the finely divided matter in suspension is removed either by sedimentation, by precipitation with chemicals, or by septic treatment. The "sludge" is the sediment so obtained and in view of its content of nitrogen, phosphate and a small amount of potash, attempts have been made to utilise this product as manure.

It has been found that the most convenient way of disposing of this sludge is to press it into a "cake" after mixing it with lime. In some cases a charge of about 6*d*. per ton is made for it, but in others the sludge is given away to neighbouring farmers or a small fee may even be paid for its removal.

Speaking generally, properly pressed sludge when in the form of a solid cake does not give rise to serious nuisance from smell, and if exposed to the air in dry weather it soon becomes entirely inoffensive. It has, however, a slight smell of fresh sewage, and if kept moist, *e. g.*, if it is exposed to the air during wet weather, it soon becomes putrid and gives rise to offensive odours. For this reason it should, if possible, be stored under cover until it can be distributed on the land, or covered in.

The composition of the pressed cake varies according to its origin ; i addition to its manurial constituents it naturally contains a good deal c lime. The actual market value, however, is insignificant owing to the rela tively high cost of carriage upon a mixture containing of necessity a larg proportion of water, grit and carbonaceous matter.

Experiments with regard to the use of various sewage sludges in agr culture were first carried out for the Royal Commission on Sewage Disposa about ten years ago.

Professor SOMERVILLE'S trials with turnips, mangolds and swedes at fiv centres did not reveal any consistent manurial effect from the sludge; an the conclusion was drawn that the nitrogen and phosphoric acid of sludg are in a much less available form than the same substances in sulphate c ammonia, superphosphate and fish meal.

In experiments carried out by Mr. MIDDLETON on grass at eight centre the application of the sludge seems to have been useful for the hay crop i the north, where the wet summer experienced favoured slow-acting manure but the sludge produced no results in the south of England. The conclusion were drawn that, for root crops and grass, the action of the nitrogenous an phosphatic constituents of sludge is very slow as compared with the effec produced by nitrogen and phosphates supplied in ordinary artificial manures that sewage sludge would not appear to be well adapted for such crops a mangolds, potatoes and swedes, which have a short period of growth and re quire quick-acting manures, and if employed it should be applied in ton rather than in hundredweights per acre; that proper quantities of sludg would be likely to form a good dressing for the slow-growing plants of man permanent pastures and meadows, and that sludge is unlikely to give satis faction on the very poor clay-soil pastures which are so much benefited b basic slag.

Dr. VOELCKER found in pot trials with wheat that those sludges did bes which contained most moisture and most lime, but that high amounts c organic matter and of total nitrogen did not produce a correspondingl good result, while all the sludges tried were somewhat inferior to artificia manures supplying equal amounts of approximately like ingredients. A increase of 10 to 12 per cent in grain and in straw over the unmanured pro duce was, on the average, obtained, as against one of 16 to 17 per cent wit artificial manuring. On the basis of the extra produce obtained, the be of the sludges was valued at 10*s*. a ton delivered on the land.

The experiment for the Royal Commission on Sewage Disposal did no end with the above trials, owing to the subsequent discovery of an efficien process for " de-greasing " the sludge. It must be explained that natur sludge contains a large amount of grease and soapy matter (equal to from 1 to 15 per cent of the dry matter). Grease is of no value as manure and, i fact, is supposed to exercise a retarding influence by preventing the read decomposition of the organic and nitrogenous matters with which it may b mixed.

The effect of these "de-greased " sludges was compared with that

natural sludges on wheat at Woburn and on hay and oats at Rothamsted in 1913-14.

At Woburn the natural sludge was found to contain more moisture, more nitrogen and more soluble nitrogen than the de-greased, an application of 1 ton per acre supplying 45 lbs. of nitrogen in the case of natural sludge and 40 lbs. in the case of de-greased sludge. The following table shows the yields of grain and straw from various dressings :

Treatment.	Weight of wheat crop (untreated = 100).	
	Grain.	Straw.
Untreated	100	100
Natural sludge :		
1 ton per acre	122	102
2 tons per acre	120	112
1 ton per acre + $^1/_2$ ton lime.	132	110
De-greased sludge :		
1 ton per acre	101	107
2 tons per acre	118	102
1 ton per acre + $^1/_2$ ton lime	122	111
Lime only : $^1/_2$ ton per acre.	113	102

Thus the average increase in grain over the untreated produce was 25 per cent with the natural sludge and 14 per cent with the de-greased. The best results were obtained with lime, but that this was not due to lime alone is shown by the yields where lime was applied without sludge.

At Rothamsted also, the nitrogen content of the natural sludge (1.76 per cent) was found to be above that of the de-greased sludge (1.55 per cent), while the content of phosphoric acid was 0.85 and 1.33 per cent respectively.

In the grass experiments the manures were applied at the uniform rate of 20 lbs. of nitrogen per acre (equivalent to about half a ton of sludge) with the following results :

Treatment	Yield of hay per acre — cwt.
Untreated	17.64
Natural sludge	18.64
De-greased sludge	16.29
Calcium cyanamide	21.59
Nitrate of soda	25.93

The effect of the sludges was negligible. It should be mentioned that the season was a distinctly dry one.

Experiments with oats were carried out on the same plan, but from neither of the sludges was so good a return obtained as where no treatment was given, the sludges being applied so as to supply 16.67 lbs. of nitrogen per acre.

The results of the Rothamsted experiments are taken to indicate the lack of evidence to the effect that the removal of the fat from the sludge increases the ease of decomposition in the soil (1).

The point towards which laboratory and other experiments should in future be directed seems to be the discovery of some method of rendering the nitrogenous matter of the sewage sludge more readily available as plant food than at present.

794 - **The Treatment of Sewage for obtaining Sulphate of Ammonia.** — KALOUCHSSKII, A. A., in *Moskovskii Selskokhosia istvennii Institut, Kafedra Chastnago Semledieliia, is resultatov veghetatsionikh opitov i laboratornikh robot, pod redaktsiei professora D. N. Prianishnikova* (Results of the Work of the Agricultural Laboratory of the Agricultural Institute of Moscow, under the direction of Prof. D. N. PRIANISHNIKOV), Year 18, Vol. IX, pp. 253-345. Moscow, 1914.

The cultivation of sewage can furnish enormous quantities of sulphate of ammonia. In Russia-in-Europe alone the human excrement contains something like 400 000 tons of nitrogen, which could yield 1 700 000 tons of sulphate of ammonia, worth some 25 millions sterling. Considering the great importance of the question, the Ministry of Agriculture entrusted the writer with making researches on the subject.

The experiments were carried out in the Laboratory of the Agricultural Institute of Moscow, their aim being to throw light upon the following fundamental factors of the problem:

1. The quantity of ammonia, or which amounts to the same thing, of sulphate of ammonia, that can be obtained by treating with lime a certain quantity of sewage with a nitrogen content similar to that of the city of Moscow sewage and, consequently, of typical faeces.

2. The quantity of lime necessary for separating the ammonia from sewage of known composition.

3. The rate of separation of ammonia from sewage.

It was also desired to obtain, as far as possible, data of an economic character by means of experiments carried out in the laboratory. The chief results of these experiments may be summarised as follows:

The average nitrogen content of the sewage was determined as 2.714 gms. per litre; it varies between 2.438 and 2.958 gms.; of this amount 71 per cent is ammoniacal nitrogen, the rest being in organic combination. The percentage distribution of nitrogen present in sewage is as follows:

	Volatile ammoniacal nitrogen	Fixed ammoniacal nitrogen	Organic nitrogen
Liquid portion	43.70	17.72	6.54
Solid portion	5.25	4.81	21.98
	48.95	22.53	28.52

(1) See also *B.* June 1915, No. 585. (*Ed.*).

This proportion must be considered as schematic, because chemical and physiological changes are continually taking place in the sewage, determining not only changes in the proportions of the different forms of nitrogen, but also changes in the total quantity of this substance according to the conditions of storage. The writer's experiments in this direction have clearly shown that while the loss of nitrogen is negligible in the case of faecal matter that has been kept for three months unexposed to the air, it is on the other hand very large when the excrement has been in contact with the air for the same length of time. This is shown in Table I.

TABLE I. — *Amount of nitrogen in liquid sewage exposed to air, gms. per litre.*

Date of analysis	Total nitrogen	Ammoniacal nitrogen	Organic nitrogen
July 11	2.438	1.641	0.797
» 15	2.297	1.655	0.642
30	—	1.164	—
August 22	1.329	0.714	0.615
October 14	0.786	0.214	0.572

It will be seen that after four days the loss of nitrogen was already 5.78 per cent of that present on July 11; a month and a half later, this loss was 45.49 per cent; and during the whole period of the experiment (95 days) it reached 67.76 per cent. The greatest loss was in the case of the ammoniacal nitrogen and amounted to 86.96 per cent in the entire course of the experiment, while the losses of organic nitrogen for the same period of time were only 28.23 per cent.

In order to solve the second part of the problem, *viz.* to ascertain the amount of ammoniacal nitrogen obtainable from the excrement on treating it with lime, the writer adopted two methods. The first consisted in separating all the nitrogen that could be obtained in the form of ammoniacal nitrogen by treating the whole mass with lime; in the second method, the volatile ammonia compounds present were first driven off by boiling and the remainder was treated with lime. It was found by these experiments that the maximum quantity of nitrogen obtainable from the sewage in the form of ammonia is 2.099 gms. per litre of liquid, which corresponds to nearly 10 lbs. of sulphate of ammonia per 100 gallons, while the nitrogen thus obtained represents about 77 per cent of the total amount contained in the liquid. Of this nitrogen, 58.40 per cent is derived from the volatile ammonia, 36.29 per cent from the fixed ammonia salts, and the remaining 5.31 per cent from the organic compounds.

With regard to the extraction of ammonia from sewage, the writer has been able to determine that the first method gives a smaller amount than the second. In order to extract the maximum of ammonia by the first method, from 10 to 12.5 gms. of lime are required per litre, in the second, 7 gms. are sufficient.

Finally, with regard to the third part of the problem, the rate of

separation of the ammonia, the writer has been able to draw the following conclusions :

The method of heating the faecal matter (whether boiling or treating with steam) has no perceptible difference upon the amount of ammonia obtained, but under the condition of the experiment, the separation of ammonia by boiling was 3 or 4 times as rapid as in the case of steam treatment. This is shown by Table II.

TABLE II. — *Ammonia obtained from sewage.*

Object of experiment	Boiling		Steaming	
	Length of boiling	Amount of nitrogen separated, percentage of total obtained	Length of treatment	Amount of nitrogen separated, percentage of total obtained
	minutes		minutes	
Rapid separation of ammonia under all its forms	15	98.97	60	98.52
Separation of volatile ammonia .	20	86.26	60	87.39
Separation of non-volatile ammonia	15	95.96	60	96.00

The general character of the process is the same in the two cases, namely the separation takes place most rapidly at the beginning of the distillation and gradually ceases towards the end. The decrease was more rapid when the separation of the ammonia was summary, and slower when only the volatile ammonia was driven off. The modifications in the rate of separation of nitrogen from the fixed ammonia salts and the organic compounds resemble (although somewhat slower) those observed in the separation of ammonia.

Treatment with lime and subsequent prolonged boiling gave only about 83 per cent of the amount of nitrogen separated by simple boiling.

Passing to the economic side of the question, the writer says that the manufacture of sulphate of ammonia from sewage containing the percentage of nitrogen found in the substance analysed is satisfactory as regards the net cost and that the product can find a sure sale in Russia.

795 - **The Phosphatic Deposits of Perlis (Malay States).** — W., in *De Indische Mercuur*, Year XXXVIII, No. 8, pp. 133-135, 9 figs. Amsterdam, February 26, 1915.

Perlis is the most northerly of the four States that the treaty of 1909 separated from Siam and placed under British protection. The phosphatic deposits found there occur in large open caves on the sides of seven very steep hills rising from the great plain. They consist of dry sandy material of a light grey colour with occasional black or yellow veins ; the origin of the phosphate is probably not animal, but purely mineral.

The phosphoric acid is chiefly in the form of dibasic or tribasic calcium phosphate, but some analyses have also shown traces of nitrogen, usually not exceeding 1 per cent, probably derived from the excrement of birds which formerly frequented the caves in enormous numbers. Analyses show that: 1) the nitrogen does not notably increase the market value of the Perlis phosphate; 2) a large part of the phosphate is in the form of bicalcic phosphate, for its phosphoric acid is soluble in weak acids, thus resembling that of basic slag; 3) the phosphoric acid of the Perlis phosphate acts more rapidly than that of bone-meal (1).

An experiment made by J. G. SPRING (*Agricultural Bulletin of the Federated Malay States*), comparing the effect of Perlis phosphate and bone-meal upon a plantation of young rubber trees, gave the following results:

	Increase in circumference	Cost
Perlis phosphate.	4.93 in.	$ 8.50
Bone-meal	5.35 in.	$ 13.0

Two experiments made in a rice-field by the Agricultural Adviser of Atieh (Sumatra) gave the results set forth in Table I.

TABLE I. — *Results of manuring rice with Perlis phosphate.*

	Manuring	Yield, in lbs. per acre
Plots of 530 sq. yds.	1. Perlis phosphate 14.3 lbs.	2670
	2. None	2250
	3. Perlis phosphate 14.3 lbs.	2515
	4. None	1770
Plots of 380 sq. yds.	1. Perlis phosphate 10 lbs.	1402
	2. Perlis phosphate 20 lbs.	1906
	3. None	1268

It should be noted that the phosphoric acid content varies much; on mixing the product an average of 18 per cent is obtained.

An analysis made at the Imperial Institute gave the results recorded in Table II.

TABLE II. — *Analysis of Perlis phosphate made at the Imperial Institute.*

	Per cent		Per cent
Ferric oxide	2.72	Sulphuric acid	3.00
Alumina	4.67	Carbonic acid	4.63
Lime	27.33	Moisture (at 100°C.)	5.61
Magnesia	1.34	Nitrogen { ammoniacal . 0.03	
Potash	0.43	Nitrogen { nitric 0.21	0.32
Soda	0.33	Nitrogen { organic . . . 0.08	
Chlorine	0.14	Phosphoric acid	21.13

(1) The product called sometimes phosphate, sometimes guano, is very probably a "guano-phosphate" (cf. ELSCHAER, C. *Corallogene Phosphat-Inseln Austral-Ozeaniens und ihre Producte*, Lübeck, 1913). (*Ed.*)

The amount of phosphoric acid equals 46.12 per cent of tricalcic phosphate. The determinations of assimilable phosphoric acid gave:

	Per cent
Soluble in water	0.002
Soluble in 2 per cent citric acid	10.70
Soluble in neutral ammonium citrate	3.55

A preliminary communication to the 9th Sugar Congress of 1911 at Soerabaia gave the following solubility percentages for the phosphoric acid contained in two samples of Perlis phosphate (see Table III).

TABLE III. — *Solubility in various solvents of the phosphoric acid in Perlis phosphate.*

Solvent	Per cent soluble
Wagner citrate	traces
Petermann citrate	1.35
2 % citric acid (5 gms. of material in 250 cc. of solvent)	10.58
» » » (1 gm. » » »)	14.10
25 % hydrochloric acid (5 gms. of material in 100 cc. of solvent)	14.73
Nitric acid + hydrochloric acid (boiled for $^1/_2$ hour)	15.43
Nitric acid + sulphuric acid	16.28

Another sample gave 15.80 per cent of phosphoric acid soluble in 2 per cent citric acid (1 gm. in 250 cc. of solvent); none of the samples showed any water-soluble phosphoric acid.

It is not improbable that the effect of Perlis phosphate might be improved by using it together with sulphate of ammonia, as is done in the case of basic slag.

Since the construction of the narrow-gauge railway, the cost of transport of the phosphate to Penang has been $ 4 (9*s* 4*d*) a ton; this will decrease when the railway with normal gauge is completed, which will be about 1917. The amount of phosphate to be disposed of may be estimated at one million tons; the concession has been granted to the "Straits Guano Company". The importation to Perlis of sulphuric acid for manufacturing superphosphate on the spot would be too expensive, and it would be better to build a sulphuric acid factory there. Exportation of the superphosphate to Japan would then be possible, but the freights are too high for it to be sent to Europe.

796 - **The Inter-Relationships between the Constituents of Basic Slag.** — COLLINS, S. H., and HALL, A. A., in *Journal of the Society of Chemical Industry*, Vol. XXXIV, No. 10, pp. 526-530, 3 graphs. London, May 31, 1915.

Of recent years little attention has been paid to the constituents of basic slag other than the lime and phosphoric acid. Considering the influence of magnesia and manganese on vegetation, it seemed desirable to make a through investigation of the other constituents.

In these investigations phosphates were determined by weighing the blue compound from the ammonium molybdate method ; calcium was determined from the oxalate precipitate and magnesium as magnesium ammonium phosphate. The manganese was precipitated with barium carbonate and titrated against permanganate; iron was determined by titration with titanous chloride using thiocyanate as indicator, and vanadium by oxidising with permanganate in sulphuric acid solution and titrating with ferrous sulphate using potassium ferrocyanide as external indicator. The citric-soluble constituents were determined by Wagner's method, the fineness by passing through a standard sieve containing 10 000 meshes per square inch. The available lime is the lime soluble in citric acid which exceeds the amount of lime necessary to combine with the phosphoric acid soluble in citric acid to form $Ca_3P_2O_8$.

From these analytical results the correlations between the citric solubility and the various constituents were determined.

Constituent.	Coefficient of correlation	Probable Error
Phosphates	+ 0.26	0.09
Silica	— 0.35	0.10
Lime	+ 0.54	0.07
Magnesia	— 0.31	0.12
Manganese	+ 0.17	0.14
Iron	+ 0.17	0.14
Fineness	+ 0.36	0.08

Thus there is a high correlation between the citric solubility and the lime content. (According to ROBERTSON this is not the case in other compounds). The correlation between citric solubility and fineness is to be expected, but it is remarkable that this correlation is less than the preceding. The evil influence of silica is strikingly shown by the figure -0.35 (a negative correlation). Magnesia also appears to diminish the solubility of the slag. Manganese, iron and vanadium may be dismissed as having no influence on the solubility. The correlation between phosphate content and solubility can be explained by the probability of better grinding of the higher grade slags and also increased phosphate means less of the other constituents which hinder the action of citric acid.

Correlation between the hay crop and the constituents of the basic slag. — The correlations between the analytical results and the crop records of the Cockle Park Experiment Station during 1904 to 1913 were then calculated.

Constituent of slag	Coefficient of correlation	Probable Error
Phosphates	+ 0.13	0.09
Silica	— 0.05	0.09
Lime	— 0.06	0.09
Magnesia	— 0.15	0.10
Manganese	0.00	0.10
Iron	+ 0.02	0.10
Citric-soluble phosphates	+ 0.11	0.09
» » lime	+ 0.15	0.09
Available lime	— 0.19	0.09
Citric solubility	+ 0.03	0.09
Citric-insoluble phosphates	+ 0.10	0.09
Fineness	+ 0.06	0.09
Ratio: CaO : P_2O_5	— 0.20	0.08
MgO: P_2O_5	— 0.26	0.10
MnO: P_2O_5	— 0.20	0.10
Fe : P_2O_5	— 0.25	0.10
SiO_2 : P_2O_5	— 0.21	0.09
CaO : P_2O_5	+ 0.06	0.10

These correlations are much less striking than the preceding. Considering general tendencies, percentages of phosphates, total, soluble or insoluble, all show positive correlations, whilst the ratios of the various bases to phosphoric acid all show negative correlations with the yield of hay. The evidence is therefore in favour of a high percentage of phosphates in slag. Grouping the results of the constituents soluble in citric acid, there is throughout a positive correlation, showing that citric solubility methods of analysis have a general value.

Plotting the results of the analyses of the 11 different slags used in the field trials with the yields, an optimum is obtained in most cases and this is not far removed from the mean composition of the slags. This regular occurrence of an optimum point for the various constituents suggests that a certain balance is needed in the various constituents of the slag. Probably a slag of medium composition is better than one of abnormal proportions. Further data are required for the more complete elucidation of this question.

797 - **Red Soils and Phosphatic Manuring in the State of São Paulo, Brazil.** — Arié, J. (Professor of agr. chemistry in the «Luiz de Queiroz» College), in *Boletim de Agricultura*, Series XV, No. 6-7, pp. 535-555. São Paulo, 1914.

The writer deals with the problem of manuring red soils, and in particular those of the State of São Paulo, Brazil, derived from the decompo-

sition of diabasic rocks. He gives an important series of analyses of red soils (cf. D'UTRA, G., in *Boletim de Agricultura*, October 1910). These show that out of 48 samples, four contained only traces of phosphoric acid; 12 up to 0.5 per thousand ; 15 from 0.5 up to 1.0 per thousand ; 10 from 1.0 up to 1.5 per thousand; six others up to 3.6, and one even 5.2 per thousand. Humus is relatively low, from a minimum of 0.24 per cent up to 2.56 per cent exceptionally, but generally about 1 per cent. The lime content varies from 0.01 to 0.65 per cent. From these data and from other analyses made by the writer, it appears that 60 per cent of the soils examined were in urgent need of phosphatic manuring and that a similar dressing would be advantageous to a further 20 per cent. This may be explained by the fact that the diabases from which the red soils are derived are in themselves poor in phosphoric acid.

Experiments were also made in order to determine the absorptive capacity of red soils for phosphoric acid, solutions of monocalcium phosphate being placed in contact with the soil samples. The results are shown in the accompanying table.

Absorption of phosphoric acid by red soils.

Length of contact	250 cc. of solution containing 0.248 050 gm. P_2O_5		250 cc. of solution containing 0.168 498 gm. P_2O_5	
	Amount remaining after contact	Amount absorbed	Amount remaining after contact	Amount absorbed
	gm.	gm.	gm.	gm.
3 hours . . .	0.216 505	0.031 545	0.119 680	0.049 268
6 » . . .	0.207 032	0.040 918	0.117 990	0.050 958
12 » . . .	0.184 840	0.053 210	0.100 890	0.068 058
1 day . . .	0.173 558	0.074 492	0.093 195	0.075 753
2 days . . .	0.152 182	0.095 868	0.087 381	0.081 567
3 » . . .	0.117 298	0.130 752	0.084 484	0.084 464
4 » . . .	0.105 197	0.142 853	0.072 730	0.097 218
5 » . . .	0.095 370	0.152 680	0.060 683	0.108 265
10 » . . .	0.067 537	0.180 513	0.042 579	0.126 369
20 » . . .	0.033 442	0.214 608	0.023 940	0.145 008

As may be seen, the phosphoric acid is almost entirely absorbed after 20 days of contact ; but this absorption is accompanied by insolubilisation and consequent retrogression. The most important factors in this fixing of phosphoric acid are lime and humus ; in fact, when a more calcareous red soil was taken, 0.225 720 gm. was absorbed at the end of 20 days instead of 0.214 608 gm. Humus contributes in its turn to regulate the absorption, but, thanks to the formation of alkaline humo-phosphates useful

to plants, it serves still more to retard and prevent the retrogression. Consequently the best way of decreasing the effects of retrogression in red soils is to turn in organic plant manures, and especially dung, as often and as regularly as possible.

The phosphatic fertilisers used at São Paulo are: superphosphate, basic slag, bones in various forms, and, in smaller quantities, mineral phosphates. When, as is most commonly the case, superphosphate is employed, the writer recommends that dung should always be used according to the following rules: 1) the dung should be well decomposed, for then it contains a considerable proportion of humates; 2) it should be well mixed with the superphosphate shortly before application, according to the phosphate content of the soil and the requirements of the crop at from 1 to 2 cwt. of superphosphate per ton of well decomposed dung. The production of the latter substance on a large scale is therefore necessary, because without this regulating fertiliser, red soils are apt to lose their good qualities, especially as regards coffee-growing.

798 – **Contribution to the Question of the Action of Sulphur on Crops.** — PFEIFFER, TH., and SIMMERMACHER, W., in *Fühling's Landwirtschaftliche Zeitung*, Year 64, Part 9-10, pp. 243-255. Stuttgart, May 1 and 15, 1915.

In 1913 field experiments on sulphur as a manure for oats had given negative results both for total yield and for utilisation of nitrogen. As the soil was very rich in organic nitrogen, and as sulphur is believed by some authorities to act specially in making available such nitrogen, it was decided to continue the experiment in 1914 to test any action of the sulphur in the second year. Eckendorf mangels were sown on twelve plots of 10 3/4 sq. yds. each, separated by unsown strips 3 ft. wide; six of the plots had received sulphur and six none. Sowing took place on April 21; at singling 12 roots were left in each of the 7 rows per plot; the mangels were pulled on Sept. 24. The individual plots showed considerable variations: the average results, with those of the 1913 crop of oats for comparison, are given in the accompanying Table.

Comparison of crops with and without sulphur.

			Without sulphur	With sulphur
Mangels, 1914:				
Fresh roots		lbs.	135.84	133.69
Fresh leaves		»	32.77	30.74
Dry matter	roots	»	16.38	16.31
	leaves	»	6.15	6.13
	total	»	22.52 ± 1.060	22.44 ± 0.959
Nitrogen in dry matter *	roots	gms.	107.2	102.7
	leaves	»	61.7	54.7
	total	»	168.9 ± 10.28	157.4 ± 6.62
Oats, 1913:				
Dry matter		lbs.	19.44 ± 0.498	19.33 ± 0.377
Nitrogen		gms.	145.9 ± 6.05	138.2 ± 2.59

* The percentage on the plots without sulphur ranged from 1.154 to 1.635 in the roots and 1.989 to 2.438 in the leaves, and on the plots with sulphur from 1.109 to 1.629 in the roots and 1.659 to 2.239 in the leaves.

These results indicate that sulphur has no favourable after-effect on yield and may have a slight unfavourable effect on nitrogen-utilisation.

In spite of the fact that some experimenters have observed an apparently favourable action of sulphur it would be premature to recommend it as a manure in farming practice.

799 - **Biology of Winter Cereals: Earing of Winter Rye and Winter Wheat sown in the Spring.** — MURINOV, A., in *Moskovskii Selskokhosiaistvennii Institut, Kafedra Chastnago Semledieliia. Is resultatov veghetatsionikh opitov i laboratornikh robot, pod redaktsiei professora* D. N. PRIANISHNIKOVA, Year 18, Vol. IX, pp. 167-245. Moscow, 1914.

It is well known that numerous cultivated plants have winter and spring forms ; but the causes of the differences they present have not yet been properly established. KÖRNICKE, in his *Handbuch des Getreidebaus*, says that: " if true winter cereals are sown in the spring, they do not form fertile shoots in the same summer ", and further on: " it appears that true winter cereals require not only a longer interval for the formation of their flowering shoots but also a definite low temperature during that period ". In his agricultural course, Prof. PRIANISHNIKOV states with regard to this question: " The principal difference between winter and spring cereals lies in the fact that *winter cereals do not form their flowering shoots in the year of sowing*, even if the sowing has taken place in the spring ". He says further, that both winter and spring cereals require a period of rest for the formation of the ear, and that this rest is longer for the former, and may be shortened by the action of a low temperature.

The writer believes that until the discrepancies between the conclusions of previous studies made under conditions often far from uniform, are eliminated, the problem of the distinction between winter and spring cereals cannot be said to be resolved ; he therefore undertook experiments under conditions approximating those of the laboratory.

These experiments were made in the glasshouses of the Agricultural Institute of Moscow in 1912 (150 pots) and 1913 (400 pots), as well as in the open, with rye and wheat, but especially the former, which is better suited to the climatic conditions of the place of experiment. The seeds used were furnished by the Institute's farm. To obtain uniform conditions in the development of the plants they were raised in quartz sand, 10 lbs. to each pot, to which was added a nutritive solution according to the rules of Hellriegel.

Eight plants were placed in each pot ; after they had rooted, these were successively reduced to 6, 5, 4, 3, 2, in order to study the action of the nutrition on the formation of the ear.

After gathering, the roots were washed, the culms were counted, and note was taken whether the plant had eared or not.

EXPERIMENTS OF 1912.

I. *Experiments with increasing concentration of the nutritive solution.* — The idea was to create artificially the period of rest for winter cereals sown in the spring by increasing the concentration of the nutritive solutions. In this case the plants were grown in aqueous solution. The

initial solution was of half the concentration given by Hellriegel ; this was then replaced by solutions at 1.5, 2, 3, 4 and 5 times the normal strength. The first solution contained 0.394 gm. of salts per litre ; the last 3.94 gms. When the concentration was five times the normal, the plants began to suffer and wither visibly; they were left for two days in this solution and the concentration was then diminished so as to reach the normal in five days ; in this, the plants were left for one day more, after which they were transplanted into pots or into the field.

Under the conditions of this experiment the plant has two critical moments : the first when the concentration of the solution exceeds that accessible to plants ; the second when they are transferred from the liquid medium to the solid substratum. The plants were gathered from the pots and the open ground on the same date in mid September.

The results of these experiments are as follows : out of 142 rye plants transplanted to pots, only 6 (4.2 per cent) eared ; out of 815 planted out in the open, none eared ; and lastly, of 30 control plants in pots, one only (3 per cent) eared. It thus appears that the check in growth of the plant had not encouraged ear-formation.

II. *Experiments with ether treatment.* — The check in growth of the plants was induced by the action of ether. The experiments were made under glass bells of 32 litres capacity, the ether being 0.4 gm. per litre of air ; the plants were subjected to its action for 24 hours, then left for 24 hours under normal conditions, and finally again subjected to the treatment for 24 hours ; they showed no sign of injury. The results of this experiment (with plants sown on May 18) are given in Table I.

TABLE I. — *Earing of rye and wheat after treatment with ether vapour.*

	Rye			Wheat		
	Total number of plants	Number of plants which eared	Percentage	Total number of plants	Number of plants which eared	Percentage
Plants subjected to ether treatment *once*	24	1	4	11	2	18
Plants subjected to ether treatment *twice* *	11	2	18	6	0	—
Control plants	42	5	12	18	0	—

* Interval of a fortnight betwen the two treatments.

It is seen that a certain proportion of untreated plants eared, while the effect of ether treatment was not constant.

III. *Experiments in freezing the germinating seeds and the adult plants.* — These experiments were repeated in 1913 ; they show that the action of low temperatures on the germinating seeds and the adult plants did not increase the number of plants forming ears, and even gave a reduction in earing.

Experiments of 1913.

Effect of date of sowing on ear formation. — The data of the 1912 experiments had shown that the date of sowing exercised a very definite action on the earing of the experimental plants. The experiments of 1913 were therefore principally directed to studying the influence of the date of sowing and of the prevailing temperature on earing. Sowings were made in the Institute's houses, on Feb. 1, March 1, April 1, April 15, May 1, May 20 and June 11. The temperature of the house remained between + 9° and + 11° C. in February ; in March it rose, and at the end of the month reached 16 or 17° C. On April 6 the pots were taken out of the house and placed in a plant-culture shelter. The growth of the plants was uninterrupted, that is they had no resting period.

Table II gives the percentages of plants forming flowering shoots for both years.

Table II. — *Formation of the flowering shoot in plants of rye in* 1912 *and* 1913 *(expressed in percentage of the number of plants).*

	Dates of sowing								
	1.II.	1.III.	1.IV.	15.IV.	1.V.	7.V.	17.V.	20.V.	11.VI.
1912	—	—	—	—	—	28.6	11.8	—	—
1913	100	98.1	95.5	50	38.4	—	—	12.5	1.6

This table shows that the percentage of ear-formation decreases regularly as the date of sowing becomes later. The data of 1912 fill the gaps in 1913 and do not influence the regularity of the curve. This regularity shows that the formation of the ear does not depend on the external conditions of any particular moment, but on those of a general character over a longer period.

On the strength of these experiments, the following conclusions are drawn :

1. Winter cereals sown in spring may produce ears the same summer, if there be the necessary external conditions.

2. The progress of development in winter cereals is the same as that of spring cereals, so that ear-formation can take place without any resting-period and without the action of temperatures below freezing-point.

3. There is no marked and essential difference between winter and spring cereals.

A bibliography is appended.

PLANT BREEDING

800 – **Selection of Maize for Protein and Oil Content in South Dakota** (1). — HUME, A. N. (Agronomist), CHAMPLIN, M. (Assistant Agronomist) and LOOMIS, H. (Analyst), in *South Dakota Agricultural Experiment Station, Bulletin* No. 153, pp. 59-77. Brookings, South Dakota, 1914.

Selection of maize for high and low protein content has been continued for four years. Both strains were selected from the same variety in 1910. The basis of the selection is the proportion of horny endosperm in the grain. The results of the four years' work are shown in Table I.

TABLE I. — *Results of selection for protein content.*

Year	High Protein			Low Protein		
	Yield in bushels per acre	Per cent of protein	Yield of protein in lbs per acre	Yield in bushels per acre	Per cent of protein	Yield of protein in lbs per acre
1910	44.6	13.11	379.13	39.2	11.20	284.98
1911	26.1	13.91	212.09	34.4	11.07	223.35
1912	53.7	12.89	411.83	46.3	12.46	343.27
1913	58.5	12.83	439.50	51.5	11.22	331.62
Average . . .	45.7	13.18	360.64	42.8	11.49	295.80

Selection for high and low oil content was also practised by mechanical selection. Since 80 per cent of the oil content of any corn kernel is to be found within the germ of the kernel it is only necessary to select for large and small germs.

The original stock used in these experiments was the same as that used in the selection for high and low protein content.

The results of three years' selection are shown in Table II.

In both cases the selection for high protein and oil content has resulted in the selection of higher yielding strains.

The great differences in the figure for oil content in both strains suggested the determination of the effect of degree of maturity on oil content. It was found that there was a considerable increase in the percentage of oil during the later stages of maturity. The great increase in the above figures can therefore be attributed to the difference in degree of maturity of the two crops.

(1) See also *B.* Sept. 1912, No. 1286. (*Ed.*).

TABLE II. — *Results of selection for oil content.*

Year	High Oil			Low Oil		
	Yield in bushels per acre	Per cent of oil	Yield of oil in lbs per acre	Yield in bushels per acre	Per cent of oil	Yield of oil in lbs per acre
1911	42.93	3.47	86.83	33.77	3.15	61.59
1912	59 92	6.10	216.97	50.63	5.66	170.66
1913	57.04	—	—	52.55	—	—
Average . . .	53.3	4.78	151.9	45.65	4.40	116.12

AGRICULTURAL SEEDS

801 – **Decree of the President of the Republic of Uruguay Fixing the Limits of Purity and Germination Capacity required in Imported Seeds.** — *Revista de la Asociación Rural del Uruguay*, Year XLV, No. 4, pp. 234-235. Montevideo, April 1915.

A presidential decree under date of April 10, 1915, determines as follows the maximum impurity allowed and the minimum of germination capacity exacted in the case of seeds to be imported into Uruguay, which must be submitted to the "Inspección Nacional de Ganadería y Agricultura":

Seed	Degree of purity: per cent	Germination capacity: per cent
Alopecurus pratensis	90	50
Arrhenatherum elatius	70	70
Atriplex semibaccata	99	80
Avena sativa	99	90
Beta vulgaris	98	160 seedlings per 100 clusters
Brassica napus oleifera	99	95
Bromus erectus	80	60
Bromus inermis	80	80
Cannabis sativa	99	80
Cichorium intybus	95	80
Corchorus capsularis	99	90
Dactylis glomerata	75	75
Festuca pratensis	90	85
Festuca rubra	80	60
Gossypium herbaceum	99	90
Hedysarum coronarium	98	85
Helianthus annuus	99	90
Hordeum distichum	98	90
Hordeum tetrastichum	98	90
Hordeum tetrastichum coeleste	98	90
Linum usitatissimum	96	95
Lolium italicum	95	80
Lolium perenne	96	80
Lolium brasilianum	95	80

Seed	Degree of purity: per cent	Germination capacity: per cent
Lotus corniculatus	90	60
Lupinus albus	99	90
Lupinus luteus	99	90
Medicago lupulina	97	85
Medicago media	98	82
Medicago sativa (free from dodder)	98	90
Nicotiana tabacum	99	90
Onobrychis sativa	98	80
Oryza sativa	99	95
Phalaris canariensis	99	95
Phleum pratense	96	85
Pimpinella anisum	98	60
Pisum sativum	99	95
Plantago lanceolata	98	80
Poa pratensis	85	60
Poa trivialis	85	70
Polygonum fagopyrum	99	95
Secale cereale	99	90
Setaria italica	95	90
Sorghum vulgare	99	95
Sorghum saccharatum	99	90
Trifolium hybridum	90	80
Trifolium incarnatum	98	90
Trifolium pratense	95	90
Trifolium repens	95	90
Triticum durum	99	95
Triticum polonicum	99	95
Triticum sativum (semi-hard and hard)	99	95
Triticum turgidum	99	95
Wheats of Rio de la Plata type	98	95
Vicia faba	99	95
Vicia sativa	99	95
Vicia villosa	99	90
Zea mays	99	85

CEREAL AND PULSE CROPS

802 - **Rice Experiments at the Ganeshkind Botanical Gardens, Bombay Presidency, in 1913-1914.** — BHIDE, R. K. (Assistant Economic Botanist), in *Annual Report on the Experimental Work of the Economic Botanist and His Staff, Bombay Department of Agriculture, 1913-14*, pp. 21-26. Bombay, 1915.

Experiments on the effect of common salt on the growth of rice showed that growth was checked and the time of flowering delayed. The colour of the husk was darker in plants growing in wet undrained soil than in drained soil and the addition of salt increased the intensity of colour still further.

Dry soil conditions and the addition of salt both diminish the size of the grain.

Several variants were observed amongst the supposed pure cultures, thus suggesting natural crossing.

A small bee identified as *Ceratina* sp. was observed to hover over the ce plants in flower and did actually collect pollen from flowers newly ened. Attempts at artificial pollination were only successful in one out 20 cases.

STARCH CROPS

– **The Effect of Selection and Size of Seed Piece on Yield of Potatoes** — HUME, A. N. (Agronomist) and OAKLAND, I. S. (Assistant Agronomist), in *Agricultural Experiment Station, South Dakota State College of Agriculture, Bulletin* No. 155, pp. 99-111. Brookings, South Dakota, 1914.

In a previous bulletin it was shown that the yield of potatoes from pieces large seed potatoes was 28 per cent higher than that from pieces of small ed potatoes. The present experiments were designed to determine the relave influence of the mere size of tuber and the strain of tuber in this inreased yield obtained by planting pieces of large tubers.

Five series were arranged as follows:

1. Seed pieces of a given size from selected tubers.
2. Seed pieces of this same size from small tubers or culls.
3. Small seed pieces from tubers of a given size.
4. Medium seed pieces from tubers of a given size.
5. Large seed pieces from tubers of a given size.

These series of plots were carried out with two varieties of potatoes, arly Ohio and Carmen No. 3.

With regard to the first two series, out of a total of 9 pairs of rows, 6 ave differences in favour of the selected tubers, though the seed pieces ere equal in size in all cases. This superiority for the two varieties averged 5.53 bushels per acre.

In the series 3, 4 and 5 the size of the seed pieces was the only variable ctor, each piece being reduced to one eye only. In every instance there as a pronounced difference in favour of the large seed pieces and the inrease in production varied with the increase in size of the seed pieces. The verage results of the two varieties (8 plots) were:

	bushels per acre	per cent
Small seed pieces	174.73	100
Medium » »	271.71	155.5
Large » »	298.59	170.9

In order to determine the effect of strain of tuber on quality of crop, crops of potatoes obtained in series 1 and 2 were weighed individually d it was found that of the tubers grown from small seed 64.8 per cent ighed 2 ounces or more, whilst the percentage from large seed was 67.5, is showing a slight superiority in the quality of the crop from selected bers.

FORAGE CROPS, MEADOWS AND PASTURES

– **The Hydrocyanic-Acid Content of Sorghum.** — WILLAMAN, J. J., and WEST, R. M. (Agricultural Experiment Station, University of Minnesota) in *Journal of Agricultural Research*, Vol. IV, No. 2, pp. 179-186. Washington, D. C., May 1915.

Since it has already been proved that sorghum poisoning is due to rocyanic acid, which occurs as a constituent of the glucoside dhurrin,

it was considered desirable to study the hydrocyanic-acid content of sorghum under Minnesota conditions.

The effect of manuring with dried blood (800 lbs. per acre) on the composition of sorghum in rich fertile soil and in poor sandy soil was determined. The growth on the latter soil was so poor that the whole of the plant had to be ground up for the determination of the hydrocyanic acid, which was effected by the colorimetric method of FRANCIS and CONNELL after hydrolysis for 2 hours at 40 to 45° C.

In general the plants which received fertiliser grew better than the controls, but the increase in hydrocyanic acid content of the manured plants was inappreciable, and less on the rich soil than on the poor sandy soil. During the first three or four weeks of the plant's life the prussic acid is concentrated in the stalk. It then rapidly decreases and disappears from the stalk, but apparently persists in the leaves in decreasing percentage until maturity. It is probable that climate and variety may be more important factors than soil nitrogen in determining the amount of prussic acid in the plant. Further experiments are being carried out to determine this point.

805 – **"Kaoliang", a New Dry Land Sorghum.** — HUME, A. N., and CHAMPLIN, M., in *South Dakota State College of Agriculture, Agricultural Experiment Station, Bulletin* No. 156, pp. 115-127, 5 figs. Brookings, South Dakota, 1914.

Kaoliang was introduced from Manchuria, where it is grown as a forage and grain crop, by the United States Department of Agriculture to fill the demand for an early-ripening grain-sorghum in the Northern Great Plains.

It was first placed on trial at the South Dakota Experiment Station in 1909 and found to be extremely variable. Selection of the heaviest and most compact heads on stalks of uniform height was made during two seasons and in 1911 selected seed was distributed to a few farmers. Distribution of seed and selection have been continued during subsequent years until at the present time the crop is grown on some thousand farms in central and western South Dakota.

It has been found to be drought-resistant and has produced satisfactory yields in the driest seasons and better yields than maize. The crop has a comparatively low moisture requirement and should be planted towards the end of May on well prepared land and kept free from weeds.

Both seeds and stalks should be utilised for forage, so that the crop does not require threshing.

806 – **Contribution to the Study of the Cultivated Varieties of Red Clover.** — RAUM, in *Fühling's Landwirtschaftliche Zeitung*, Year 64, Part 1, pp. 7-20. Stuttgart, January 1, 1915.

The writer discusses the morphological and physiological differences between the two varieties of red clover (*Trifolium pratense*): these are the wild red clover (*T. p. perenne*) and the cultivated red clover (*T. p. sativum*), the latter of which may again be divided into early and late forms distinguished chiefly by the time of flowering. A number of descriptions of these two forms of cultivated red clover are quoted from old and recent works.

TABLE I. — *Yield of hay from clovers of different origin.*

Place of origin	1913 1st cut (Aug. 15)	1913 2nd cut (Sept. 30)	1914 1st cut (June 10)	1914 2nd cut (for seed)	Total 1913+1914
	Aver.: 20.5	Aver.: 4.8	Aver.: 24.6	Aver.: 40.3	Aver.: 89.8
Adlikon, Switzerland	+ 1.5	+ 4.4	— 3.7	+ 15.4	+ 17.8
Black Forest, W. Germany	+ 2.0	+ 0.9	+ 4.2	+ 2.6	+ 9.7
Sumiswald, Switzerland	+ 2.2	+ 3.3	— 4.0	+ 5.9	+ 7.9
Silesia, E. Germany	± 0.0	— 1.1	+ 1.8	+ 5.5	+ 6.6
Posen, E. Germany	+ 1.1	— 0.9	+ 3.5	+ 2.0	+ 6.2
Styria, Austria	+ 2.4	+ 2.6	— 2.4	+ 5.7	+ 5.7
Möen, Denmark	+ 0.7	— 2.4	+ 5.3	+ 0.2	+ 4.0
Bohemia, Austria	+ 1.8	± 0.0	+ 1.3	— 1.1	+ 2.6
Loosdorf BR 11, Bohemia, Austria	+ 0.4	— 0.2	— 0.7	+ 2.0	+ 1.8
Lower Bavaria, S. Germany	— 1.8	— 0.2	— 1.1	+ 1.1	— 1.5
Brabant, Holland	+ 3.5	+ 0.9	— 6.6	— 3.7	— 3.5
Styria, Austria	+ 2.2	+ 2.6	— 3.7	— 3.5	— 4.2
Loosdorf PR, Bohemia, Austria	+ 0.9	+ 0.7	— 2.0	— 5.5	— 5.3
Herrliberg, Switzerland	— 3.7	+ 1.3	— 3.3	+ 5.3	— 5.3
Svalöf, Sweden	— 3.7	— 1.5	+ 4.2	— 7.9	— 8.6
Vejenbrod, Denmark	— 5.5	— 2.2	+ 4.4	— 6.6	— 9.7
Lyngby, Denmark	— 2.6	— 1.8	+ 0.4	— 9.7	— 13.0

TABLE II. — *Yield of clovers from different countries.*

Country of origin	1913		1914		Total
	Hay	Aftermath	Hay	Seed-hay	
Switzerland	22.4 ± 2.0	8.5 ± 0.9	20.9 ± 1.3	49.9 ± 4.8	101.9 ± 5.5
Scandinavia	16.5 ± 4.0	3.1 ± 0.7	27.5 ± 4.2	32.1 ± 4.2	79.2 ± 7.0
Styria	22.9 ± 0.7	5.1 ± 0.9	21.3 ± 4.6	40.3 ± 6.6	89.5 ± 11.0
Eastern Germany	21.3 ± 2.4	4.2 ± 0.9	28.2 ± 2.4	43.8 ± 2.4	97.5 ± 5.7

Trials of red clover of different types and from different localities have been in progress since 1913 at the Seed-Selection Station of Weihenstephan, Bavaria. The clovers were sown between the 10th and 23rd of May 1913, without a nurse crop, in rows 8 in. apart on 120 plots

measuring 40 ft. by 6 ft. 6 in. separated from one another by 20-inch strips not sown, the soil is a damp clay and no manure was given; the amount of seed averaged 13 ½ lbs. per acre. Table I gives the hay crops of 1913 and 1914, in terms of the deviation from the average, the figures being in lbs. per plot (of about 26 sq. yds).

The average figures for Switzerland (excluding Herrliberg), Scandinavia (excluding Möen), Styria, and Eastern Germany are shown in Table II.

In 1915 some further plots were added.

807 – **"Pasto salitrero" (*Sporobolus phleoides*), a Forage Grass for Sterile, and especially Alkaline, Soils.** — Diaz, C., in *Boletín del Ministerio de Agricultura*, Vol. XIX, Nos. 1-2, pp. 40-43. Buenos Ayres, January and February 1915.

Sporobolus phleoides Hackel is a grass indigenous in the vast alkaline formations ("salitrosas") of the north-western part of the Argentine Republic. It is especially suitable for widespread cultivation for fodder, and by this means large stretches of land, hitherto sterile, could be used for stock-rearing. This grass is a perennial, confined to alkaline soils and very drought resistant; plants kept under observation for four years showed luxuriant growth in spring and summer sometimes reaching 3 ft. or more in height; the growing period begins in August (the southern spring) and the plant tillers freely and continuously until the winter, when it ceases to grow. "Pasto salitrero" supplies a fodder liked by both cattle and horses.

The chemical composition of air-dried *Sporobolus phleoides* is as follows:

	per cent		per cent
Moisture	14.41	Carbohydrates	30.17
Fats	2.80	Soluble ash	4.06
		(including NaCl	1.77)
Nitrogenous substances	8.30	Insoluble ash	4.23
Crude fibre	23.15	Undetermined matter	12.88

Analysis of the surface soil in which *Sporobolus* grows, shows clearly that no other cultivated plant could exist there; the following are the figures:

	per cent		per cent
Moisture (hygroscopic)	2.25	Humus	1.25
Fine sand	62.50	Lime	2.14
Clay	20.36	Salts soluble in water	11.50

The best time for sowing this grass would seem to be at the end of summer or in early autumn; in any case, owing to its somewhat slow initial development, it ought always to be sown in a relatively warm, damp period, from spring to autumn; as the seed is very small, it is well to mix it with sand, which allows of it being sown broadcasted in strips 10 or 12 ft. apart, leaving the spaces to be sown by the wind. A preliminary ploughing is sufficient preparation; all live stock must be kept off the field for two years.

Pieces of land can be sown progressively year by year; this crop has the .dvantage of removing injurious salts from the soil, and at the same time mproving it by formation of humus; the dung from the stock will act in he same way, so that after a few years the ground is ready for the ordinary rops in rotation.

308 - **Aquatic Plants that can be Fed to Live Stock.** — HEYKING, in *Georgine*, Year 8, No. 35-36, pp. 169-170. Königsberg i. Pr., May 1, 1915.

Among aquatic and swamp plants many can very advantageously be ed to live stock, others are almost valueless and a few are decidedly oisonous,

One of the most valuable of these plants is ribbon grass (*Phalaris rundinacea*). In sunny sheltered ponds on rich clay it reaches a height f about six feet; it yields two cuts a year and by the judicious use of itrogenous and phosphatic manures even three; it must be cut before lowering, otherwise it gets too hard and is then not much relished by attle; when cut it is bound in sheaves and set up in stooks to dry. It as about the same nutritive value as oats.

The common reed (*Phragmites communis*) occurs on almost all the at banks of standing or slowly running waters. It thrives in many ifferent soils, chiefly sandy ones, and can be multiplied by seed or rhizomes. t also yields two or three cuts every year. When young it is excellent odder for horses; the first cut (when the leaves project about 20 inches bove the water) and the third cut (about the end of August or in eptember) are best done close to the ground, the second cut (about he end of June) must be above the water level or the plant is liable to be njured. It is fed either green, chopped with straw, or dried like ribbon rass, and is very nutritious..

Floating manna grass (*Glyceria fluitans*) occurs in stagnant and slowly owing water. It can be cut three or four times a year and both in the green tate and dried as hay it is much relished by cattle and horses. The seeds re collected in Prussia, Silesia, Poland, etc., where they are much esteemed s human food.

Glyceria aquatica and *G. spectabilis* are both readily eaten by stock.

Pigs and poultry can be fed a great number of other water plants, ther green or chopped and steamed, such as water-lilies, duckweed, ater-cress and pondweed.

309 - **Egyptian Cottons under Experiment in Algeria.** — DUCELLIER, L., in *Bulletin Agricole de l'Algérie-Tunisie-Maroc*, Second Series, Year 21, No. 4, pp. 85-92. Algiers, April 1915. FIBRE CROPS

In the season 1912-13 a number of selections from Egyptian cotton ere under trial on the experimental field at Perrégaux (Ferme-Blanche) the Department of Oran. Several were eliminated in 1913-14 for late owering or faulty bolls, so that only the following remained:

No. 18	Yanovitch	No. 42	Mitafifi
No. 33	Abassi	No. 62	Mitafifi
No. 34	Abassi	No. 102	Yanovitch
No. 36	Mitafifi		

The results are given in the accompanying Table.

No. of variety	Average no. of bolls per plant		Average yield, in lbs. per acre	
	1913-14	1912-13	1913-14	1912-13
42	34.7	40.0	2010	1520
36	33.6	37.9	1870	1700
18	35.7	35.1	1870	1430
102	32.2	42.0	1850	1960
33	27.2	42.1	1680	1520
34	29.1	35.7	1520	1610
62	33.1	44.0	1250	1960

The yielding power of the strains selected in Algeria remains superi to that of the original imported seed, in particular as to regularity. Fu ther, the yields have always been better than those of mixed lots.

No. 62 has constantly shown great uniformity and fertility and is su ficiently early to be profitable every year. Nos. 36 and 42 are also goo for fertility and yield of lint. Nos. 18, 33, 34 and 102 are fixed types sui able for commercial growing in the plain of Perrégaux, but are not equ to the other three in qualities required by the planters and the spinners.

810 – **Improvement of Cotton in India.** — I. LEAKE, H. M. (Economic Botanist to Gover ment, United Provinces): The Breeding of Improved Cottons in the United Provinc II. CLOUSTON D. (Deputy Director of Agriculture, Central Provinces), Cotton Improveme in Berar. — *The Agricultural Journal of India*, Vol. X, Part II, pp. 111-128 and 148-1 Calcutta, April 1915.

I. — The improvement of the cotton crop concerns both yield a quality. The former is dependent upon the habit of growth of the plan the ginning percentage (1) and the size of boll. Quality is a more compl factor owing to the highly organised and fluctuating state of the market Thus, the Lancashire market requires long-staple cottons such as are pr duced in Egypt and America, whilst the Continental and Eastern marke require short-staple cottons as produced in India and the East generally.

The outstanding requirements of the trade with regard to quality ar 1. length of fibre : 2. twist of fibre ; 3. fineness of fibre. The length a twist of the fibre are important in conferring strength to the thread, and t fineness of the fibres enables a large number of fibres to be spun togeth for a given diameter of thread, thus conferring greater strength. The ide plant may therefore be defined as one possessing : early maturity (und Indian conditions) ; a profusion of large bolls; a high ginning per cen a long, fine, uniform fibre with a good natural twist ; a good colour and fr

(1) See *B.* Feb. 1914, No. 173. (*Ed.*)

dom from nep (debris and waste fibres). The production of this plant is the aim of the selection experiments that have been in progress during recent years.

Of the indigenous species of *Gossypium* in India only one, *G. neglectum* (or probably *G. indicum*), was found to possess the ideal habit, *i. e.* early maturity and a profusion of fertile branches, but it is characterised by a short and coarse staple. The size of boll and ginning per cent vary considerably. These characters however are to be found par excellence in *G. cernuum*, or Garottill cotton. Length of fibre is found in *G. arboreum*, which has a staple of 1 inch. A fine silky lint is found in *bani* cotton (*G. wightiana* (1)), which is as fine as American cotton. Numerous single crosses between these three species have been made and several very promising hybrids have been isolated. The work is being continued and already there is promise of obtaining hybrids combining the good characters of all three species, thus approaching to the ideal type previously defined.

Fortunately it has been found that habit of growth is not synonymous with early maturity and a long-stapled early-maturing plant has been obtained.

There is, however, reason to think that high ginning per cent and fineness of fibre are mutually exclusive, at least to a certain extent. The limiting figure is not yet determined, but it is undoubtedly higher than that of the *bani* crop and possibly may be as high as 36 per cent.

II. — Improvement in the cultivation of cotton has been more rapid in Berar than in some other parts of India, owing to its greater fertility and more advanced state. As a rule improvement is most difficult where soil and climate are unfavourable to growth.

The first improvement consisted in the analysis of the cotton crop, which was found to consist of a mixture of six varieties varying in yield from 97 to 204 lbs. per acre. The selection of *G. roseum* as the highest individual yielder and its distribution by means of seed-farms has resulted in great increases in yield and profits throughout the province.

Rotation experiments were tried with cotton, wheat and leguminous crops and it was found that over a period of 7 years the best results were obtained by growing cotton continuously on the same ground.

The practice of topping the cotton plants when about 1 foot high to stimulate branching had previously been recommended by the Department of Agriculture, but when tested experimentally it was found to give lower yields. It has therefore been abandoned.

The best spacing distance for cotton plants was investigated and it was found that the distance between the plants should vary in proportion to the fertility of the soil. For a soil of medium fertility the best results are obtained by planting 15 inches × 7 inches.

Owing to the scarcity of cattle manure, manurial experiments were carried out with artificial manure. The soil appeared to be deficient in

(1) According to WATT'S *Dictionary of Economic Products of India.* (*Ed.*)

nitrogen and phosphoric acid and it was found most profitable to apply a top-dressing of nitrate of soda or saltpetre as a supplement to a light dressing of cattle dung. In this way the harmful effect of the soda on the physical texture of the clay was avoided. The most useful result of these experiments is the manurial value of cattle urine absorbed by a layer of 6 inches of dry earth in the cattle stalls. It was found to be equal to that of the solid excreta. This practice is now being adopted with excellent results.

The introduction of the variety *roseum* alone has resulted in increasing the total profits of the cultivators by a sum greater than the total expenditure of the Agricultural and Veterinary Departments.

CROPS YIELDING OILS, DYES AND TANNINS

811 – **The Improvement of Indigo in Bihar, India : Second Report.** — HOWARD, A., and HOWARD, G. L. C., in *The Agricultural Journal of India*, Vol. X, Part., II, pp. 167-179, 1 plate. Calcutta, April 1915.

This paper deals with the establishment of the seed supply, improvement in the yield, and the use of cover crops, for indigo.

Owing to the difficulty of the seed supply the area under this crop fell from 70000 bighas in 1910 to 15 000 bighas in 1913. It is advisable to grow a special crop for seed on high-lying well-drained lands. For this purpose the seed should be sown in August in lines 2 ft. apart and the crop harrowed and weeded. The plants should be thinned in October to 9 inches apart. Air and light are necessary for the production of side branches for the formation of flowers and for ensuring the visits of bees.

Upon the proper cultivation of the soil depends the development of root nodules, without which indigo gives a poorer crop of seed and a lower yield of indican. Plants grown in rich or badly drained soil do not develop nodules and give a low yield of indigo and poor seed. The yield of indigo depends largely on the supply of oxygen to the roots. This air supply is maintained by thorough cultivation immediately after the cereal cover crop is removed. Cross cultivation should follow in April or May with a spring-tooth cultivator. The land should also be well drained to prevent water-logging.

On cutting the first crop a few leaves should remain to continue the transpiration and prevent starvation and stagnation of the root nodules. This practice alone increase the yield by 30 per cent at Pusa.

An indirect method of improving this cultivation is by the use of a more valuable cover crop. This is found in a new wheat, "Pusa 4", which is a rapid grower, does not tiller much, and has a very strong straw provided with few leaves. The grain separates out easily in the threshing and commands a good price in the market.

RUBBER, GUM AND RESIN PLANTS

812 – **Rubber in Abyssinia.** — *The Indian Rubber Journal*, Vol. XLIX, No. 14, p. 2. London, April 3, 1915.

All the rubber exported from Abyssinia is harvested by the natives from wild plants growing in the large forests in the south-west. A plantation exists near Gambela on the land of the "Baro Syndicate". No recent information is available on the state of this plantation, which has not yet arrived at maturity.

The exportation of rubber is a government monopoly controlled by the Imperial Ethiopian Rubber Administration. The yield in 1913 was affected considerably by the low prices prevailing in Europe amongst other things. Thirty-four tons were exported from Gambela and 37 tons by way of Djibouti. Abyssinian rubber realises about 1*s* 2*d* a pound on the London markets, and on the basis of 3*s* for "Fine Hard Para" it would be valued at 1*s* 6*d* a lb. (1).

813 - **The Cause of Variability in Plantation Rubber** (2). — EATON, B. J., and GRANTHAM, J. in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 5, pp. 175-203. Kuala Lumpur, F. M. S., February 1915.

These experiments represent the first attempt to solve the question of the variability of plantation, rubber carried out in the newly established vulcanising and testing laboratory of the Agricultural Department, Federated Malay States.

The writers found that the most obvious indication of variation in plantation rubber appears in the rate of cure or vulcanisation, thus supporting the statements of Mr. Williams, representing the manufacturing interests, at the 3rd International Congress of Tropical Agriculture, London 1914, who quoted figures showing that the variation in the rate of cure of different samples of plantation rubber may be as much as 100 per cent. Since the degree of vulcanisation determines to a large extent the mechanical properties of the product, it is necessary to determine the rate of vulcanisation of a sample of rubber before making any conclusions as to its elasticity or tensile strength. This variation in the rate of cure is of vital importance to the manufacturers and the writers therefore consider it to be the crux of the whole problem of the variation of plantation rubber.

To determine the causes of this variation, samples of rubber were prepared by various methods, *viz*: acid coagulation followed by smoking or crepeing the sheets, smoking in thin films similar to the Brazilian process, and vulcanising for different periods ranging from 1 to 3 hours, at a temperature of 140° C. The mechanical properties of the vulcanised samples were determined as the load and elongation at breaking point.

It was found: 1) that slab rubber (*i.e.* rubber not subjected to much pressure after coagulation) and rubber coagulated by smoke cure much more rapidly than plain crepe or smoked sheet (*i.e.* rubber subjected to heavy rolling after coagulation); 2) that unsmoked sheet cures more rapidly than smoked sheet or plain crepe; (3) the crepeing of dry sheet previous to mixing has no effect on the vulcanising properties of the rubber.

Thus, it appears that removal of the serum from the coagulated rubber and smoking are factors which retard the rate of vulcanisation.

In explanation of these facts the writers offer two alternatives: 1) The latex contains, in addition to caoutchouc, some constituent which influ-

(1) According to J. Q. WOOD, Consul-General of the United States at Adis Abeba (*Supplement to Commerce Reports*, No. 796, p. 9, June 14, 1915), the exports of rubber from Abyssinia in 1913 reached nearly £20 000. (*Ed.*)

(2) See also *B.* June 1914, No. 522; *B.* June 1915, No 642. (*Ed.*)

ences the rate of cure, is not precipitated by ordinary acid coagulation and, is apparently destroyed by smoking; 2) this substance may not exist as such in the latex but may be formed subsequently from some constituent of the latex.

It has already been shown that albuminous and basic nitrogenous substances have a remarkable influence in accelerating the rate of cure. It is therefore possible that decomposition products of the proteins of the latex may act as accelerators of the vulcanisation and that their removal by washing and pressure is the cause of the variation in the vulcanising properties of various rubbers. This hypothesis is supported by the fact that the addition of antiseptics which prevent putrefaction retards the rate of vulcanisation.

This theory will also account for the characteristics of Fine Hard Para rubber, which always contains the entire constituents of the latex and is thoroughly smoked. Its rate of vulcanisation is comparatively slow and always uniform.

Further experiments are in progress: 1) with a view to separating the accelerating substance from the serum of the latex and determining the effects of its addition after coagulation ; 2) to determine the possibility of removing the catalyst from rubber by prolonged washing in water ; 3) on the effect of using different coagulants and salts.

814 - **Scientific Experiments on the Tapping of *Hevea brasiliensis*.** — De Jong, A. W. K., in *Mededeelingen van het Agricultuur-chemisch Laboratorium*, No. 10, 83 pp., 19 figs. Buitenzorg, 1915.

Experiments on tapping to different depths showed that ordinary tapping gave a yield equal to 52 per cent and deeper tapping 80 per cent of that obtained on tapping right down to the wood. The width of the strip of bark removed, however, has no influence on the yield.

The direction of tapping (from above downwards or vice versa) did not give different results.

The rapid flow of latex obtained by means of repeated tapping would tend to prove that the stoppage of the flow should not be attributed to a lack of latex, but to the closing of the latex tubes. Experiments made with trees tapped throughout their circumference showed that after a time the latex produced could not be coagulated by acetic acid, thus giving additional proof that the cause of the stoppage of the flow of latex is due to a closing of the latex tubes.

As the result of preliminary experiments it appears that the evaporation of the latex and the drying of the bark have only a slight influence or none at all on the yield of rubber if the tapping cuts are re-opened each day.

When the distance between the cuts is 20 inches, the lowest generally produces more caoutchouc than the highest ; if they are still further apart this is not the case. Daily or alternate-day tapping of the same tree showed that in the latter case the cuts were not sufficiently deep, probably owing to the drying of the bark. The strip of bark removed does not appear to have any great influence on the yield of rubber. When it affects the flow

f sap the yield from each cut is diminished ; otherwise wounding results n a greater local formation of rubber.

Young bark yields more rubber than old bark. Experiments carried ut on the same and different trees have shown once more that left-hand apping is preferable to right-hand tapping. Little or no difference occurs etween the yield from a single ' V ' and a single cut to the left. Experiments with cuts at different angles to the vertical show that the cut with he steepest inclination removes the greatest quantity of bark, while the ield of rubber (when the experiments were carried out on different trees) aried very little. When the cuts were made on the same tree, a vertical ut gave about half the yield of a cut forming an angle of about 50° with he vertical.

Experiments on the height of tapping on the same tree show that :) there is no advantage in making one or two cuts above rather than below a previous cut ; 2) two cuts starting from the middle of the tapping rea give a better result than two cuts made in the ordinary way at a distance of 10 to 14 inches, but in view of the results reported in *Teysmannia* 1913, 530, 745 ; 1914, 139, 337, 447), it is not probable that this would e the case in actual practice. The experiments also show that the influence of a new cut on an old cut appears in less than an hour, if the two uts are not too far apart vertically, and also if they are at the same height nd only 2 inches apart. If, however, they are at the same height but far nough apart to be on opposite sides if the tree, no difference is observed ven after one hour. This fact also shows that the transport of the latex long the latex vessels in Hevea occurs with great facility. With tapping wice a day, equilibrium was established four hours after the first cut, and id not change for the rest of the day.

In trees tapped by a cut right round the trunk, the latex from above he ring was found to contain tyrosin and its derivatives as well as tyrosinse, whilst the latex from below this ring contained only tyrosinase. It as found also that isolated pieces of bark may produce rubber.

The girths of Hevea trees at the respective heights of 4, 34 and 53 nches are proportionally as 1.60 : 1.13 : 1.

Opening the same cut twice per day economises the bark, and it is nore advantageous to effect the second cut at 10 a. m. if the first cut was nade at 6 a. m. Another cut on the opposite side of the tree has little influence on the yield of the first cut, and conversely the closing up of one of he opposite cuts has only a slight effect in increasing the yield from the ther (1).

15 – **Rubber Tapping Experiments in Ceylon** (2). — PETCH, T. (Government Botanist and Mycologist) – I. Hevea Tapping Results: Experiment Station, Peradeniya, 1911-1913 ; II. Hevea Tapping Results: Experiment Station, Peradeniya, 1914 ; III. The Tapping of an old Hevea Tree at Henaratgoda.— *Department of Agriculture, Ceylon, Bulletin* No. 12, 28 pp. ; No. 17, 16 pp. ; No. 13, 4 pp. Colombo, 1914-1915.

I. These tapping experiments were begun in 1912 with trees planted as umps in 1905. One series to determine the difference between tapping on

(1) See *B.* Sept. 1913, No. 1039. (*Ed.*)
(2) See also *B.* Jan. 1915, No. 43. (*Ed.*).

alternate days and tapping daily during alternate months was carried ou on trees not previously tapped. Two tapping systems were used in thi test, *viz*: half herringbone to the left and full herringbone. The yields a the end of the first year showed very little difference between the two tim systems in the case of the half herring bone, but alternate day tapping o the full herring bone system gave considerably more (12 ½ per cent per tree than daily tapping in alternate months. In the second year the same re sult was obtained for the full herringbone system, but in the case of the hal herringbone system the opposite result was obtained. Comparing the yield of the tapping areas completed at the end of May 1913, there is practicall no difference between alternate day tapping and daily tapping during al ternate months in the case of the half herringbone system, but nearly 1 per cent difference in favour of alternate day tapping in the case of the ful herringbone system. Considering that the half herringbone occupies onl one quarter and the full herringbone one half of the circumference, it migh have been expected that the loss of " wound response " resulting from pro longed rest would have been greater in the former than in the latter system

Another series of experiments to compare different methods of tappin on one-third the circumference was begun on trees which had previousl been tapped on one side. Three plots were arranged to show the effect o the difference of the tapping interval with the same system of tapping. Th results confirm those of previous experiments, showing that the yield pe tree increases with the interval between the tappings, but that the tota yield in a given period diminishes. Two other plots showed the superiorit of two cuts at two feet apart over two cuts at 1 foot apart. Up to th present this experiment does not support the popular view that " th nearer the base the better the yield ".

Comparison between tapping opposite quarters, *i. e.* half the circum ference, with cuts of one-third the circumference on the half herringbon system, showed a higher yield from the former method, but considerin that one half of the tree is tapped in the former case and only one-thir in the latter the results appear to indicate an advantage in tapping on one third of the circumference.

This system also gives better yields than the basal ' V ', probably o account of the greater number of cuts rather than their positions.

These results however refer to young trees and may require to b modified as a result of later experiments. Experiments with picking instru ments gave inferior yields to the incision method, and often showed seriou physiological disturbance in the trees.

II.—These experiments are continuous with the preceding and are de signed to show the difference in yield and the effect on the trees of variou systems of tapping differing in their time interval.

Comparing alternate day tapping with daily tapping during alternat months, the advantage in favour of regular tapping in the case of the fu herringbone system has diminished to 8 per cent of the total yield of th two sections. It would appear that the yield from the two full herringbon tappings are now approaching equality, thus pointing to the conclusio

that it is immaterial whether the trees are tapped on alternate days throughout the year or daily during alternate months.

Experiments on tapping one-third circumference at different intervals and with different numbers of cuts were continued and the results showed a marked increase all round. This increase, however was greater, in the case of 2 cuts one foot apart than with 2 cuts 2 feet apart, thus suggesting that the prolonged tapping on a single section which occurs with 2 cuts 2 feet apart has a detrimental effect on the yield. The same phenomenom occurred with trees tapped daily (6 times a week) by a single cut.

Experiments with the basal V system showed better results with the single V tapped continuously than with two V's alternately, or with the half herringbone 4 cuts on one-quarter of the circumference. It was, however, still slightly less than 4 cuts on one-third, the circumference. The practice of opening trees by a single cut appears therefore to be justified, though it remains to be proved whether the V is superior to a straight cut.

In January 1914 an experiment was begun on 2 plots of 10 trees to compare V tapping with simple oblique cuts. One group was tapped on one-third circumference with a single V beginning at 3 feet and the other by a simple oblique cut to the left at the same height. The trees were tapped on alternate days. The average girth of the two groups was 28.5 and 28.8 inches respectively. The yields per tree were 1170 grams and 1265 grams respectively, giving a difference of 8 per cent in favour of the simple oblique cut, which is about the amount expected from theory. During 1914 two groups of 17 trees were used to test the effect of changing the tapping from one side of the tree to the other at intervals of three months. The average girth of the trees in each group was 30.2 inches and the natural superiority of the group with continuous tapping was about 4 per cent. At the end of the year the difference in yield between the two groups was 14 per cent in favour of continuous tapping down one side of the tree.

III. — This bulletin gives the results of 5 years' tapping of a rubber tree planted at Henaratgoda in 1876. Tapping was begun in 1908 on a full herringbone system of 3 V's extending over one-half the circumference, which then measured 9 ft 5 inches at 6 feet from the ground. The tree showed perfect bark renewal after the first tapping, and tapping of the renewed bark on one section was begun when it was 2 years 4 months old. On two other sections the renewed bark was tapped when about 3 years old, and on the fourth section at 1 year and 10 months old.

The results of these tapping periods are summarised as follows :

	lbs.	ozs.
Original bark	172	0
Renewed bark 2 1/3 yrs. old (completely tapped) . .	100	10
» » 3 yrs. old (partly tapped)	22	9
» » 1 5/6 yrs. old (completely tapped) . .	97	4
Total yield during 5 yrs. . . .	392	7

This tree has therefore yielded an average of about 80 lbs. of rubber during 5 years with a bark renewal considerably less than 4 years.

816 – **New Simplified Schadt Process for the Preparation of Rubber.** — VRIENS, J. G. C. in *Mededeelingen van den Adviseur der A. V. R. O. S. over* 1914, pp. 51-52. Medan, Sumatra, January 1915.

According to SCHADT'S new process, already used in several places in the Dutch East Indies, a thin layer of latex is spread on tin plates with recurved edges. After some time, the water having evaporated, there only remains a thin coating of rubber. The films thus obtained are smoked by revolving them in a drum covered with perforated sheet-iron, and are subsequently compressed into blocks. On the second day after tapping, the rubber is ready for despatching. The rubber thus retains the original latex elements, while the cost of production is reduced to a minimum. It appears that this process is a step in the right direction towards obtaining uniformity of the product.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

817 – **Researches on Hop Hybrids.** — SCHMIDT, J. Investigations on Hops (*Humulus lupulus* L.) : VI–On the amount of lupulin in plants raised by crossing; VIII–On the flowering-time of plants raised by crossing. — *Comptes-rendus des Travaux du Laboratoire de Carlsberg*, Vol. XI, Part 4, pp. 165-183 and 188-193. Copenhagen, 1915.

New researches belonging to the series begun upon the hop by SCHMIDT (*Comptes-rendus des Travaux du laboratoire de Carlsberg*, passim).

I. *Lupulin content of hop hybrids.* — Numerous details respecting crossing-experiments carried out in 1911 with a large number of varieties of hop ; the data obtained are clearly set forth in very complete tables : 21 female plants of cultivated hops from Denmark, England, Austria and Germany were crossed with wild male Danish plants ; 774 hybrids were obtained in this manner and the cones analysed. The results obtained showed that, in spite of the presumably low lupulin content transmitted by the wild male plants, there were always hybrids (maximum variations) with a higher lupulin content than the female parents.

II. *Date of flowering of hop hybrids.* — Similar crosses were made in 1911 between 23 Danish, English, Austrian and German cultivated female plants and wild Danish male plants ; 874 hybrids were raised. In this manner early and late (extreme variations) hybrids were obtained. On comparing the average flowering-date of the female parents with that of their offspring, notable differences are often to be observed.

818 – **Connection between the Composition of Javan Tobacco and that of the Soil on which it Grows.** — COHEN, N. H., in *Proefstation voor Vorstenlandsche Tabak, Mededeeling* No. 11, 18 pp., 3 figs. Buitenzorg, 1914.

The writer made chemical and mechanical analyses (the latter according to E. C. JULIUS MOHR'S method, — cf. O. DE VRIES: *Mededeeling van het Proefstation voor Tabak* No. 1) of samples of twenty tobacco soils in the island of Java. The samples were taken to a depth of 9 inches for the surface soil, and from 9 to 15 inches for the subsoil ; the following determinations were made : potash soluble in 25 per cent hydrochloric acid phosphoric acid ; lime (surface soil only) ; phosphoric acid soluble in 2 per

cent citric acid ; lime soluble in 10 per cent ammonium chloride. Determinations for the tobacco included: ash, potash, phosphoric acid, lime, magnesia and chlorine ; in addition, the exact colour of the ash was determined by a scale of 10 shades of grey obtained by mixing 5,10, etc., up to 50 per cent of animal charcoal with calcium carbonate.

The results obtained are summarised as follows :

1. The citric-soluble phosphoric acid decreases as the soil becomes heavier and more disintegrated.

2. The content of so-called " available " lime in the various soils is proportional to the amount of the " very fine " fraction of the soil.

3. The proportion between the lime soluble in 25 per cent hydrochloric acid and the amount of " available " lime is in inverse ratio to the amount of " very fine " soil and approaches unity.

4. There is no connection between the amounts of potash present in the tobacco and the soil respectively.

5. There seems to be some relation between the amount of phosphoric acid in the tobacco and in the soil; heavy soils poor in citric-soluble phosphoric acid produce a tobacco with a lower phosphate content than tobaccos grown on light soils.

6. There is a certain connection between " available " lime in the soil and the lime content of the tobacco.

7. In the case of the tobacco, no connection could be established between chlorine and potash contents and combustibility.

8. On the other hand, some connection exists between the lime content and the colour of the ash ; the higher the lime content, the lighter the colour of the ash.

9. There is no certain connection between the amount of magnesia present in tobacco and the colour of the ash.

819 – **Researches on the Curing of Tobacco in Java.** — I. De Vries, O. Proeven met kunstmatige opdroging van tabak. — II. Jensen, H. Invloed van groen licht op het opdrogen der tabaksbladeren. — *Proefstation voor Vorstenlandsche Tabak, Mededeeling* No. 10, 22 pp., 4 figs. Semarang-Soerabaia and The Hague (undated).

I. — Experiments were carried out in a drier of somewhat primitive construction heated by a wood stove and aerated by a horizontal electric fan. In spite of the provisional plant, it has been shown that if the temperature and moisture are well regulated in the interior of the drier, the curing proceeds normally and the flexibility of the leaf is maintained to the end ; the chief condition of success appeared to be the hermetic closing of the drying-shed. It was found that the air could be kept moist by passing it through a series of pieces of sufficiently thick cloth continually steeped in water ; sprayers gave no results. The experiments will be repeated in a more scientific manner to discover whether it is possible to regulate the processes of tobacco curing.

II. — Previous experiments on the influence of differently coloured light and of darkness upon the development of tobacco leaves, published by the writer in 1903, showed that plants placed in darkness and exposed to green or blue light begin after a time to suffer from lack of assimilation,

while the function of respiration is less affected. It was therefore to be expected that during the first period of curing (while assimilation and respiration are still going on in the detached leaf), light would have some effect upon the process, and consequently upon the product, and that during the second period (while the leaf is changing colour) light might also play an important part in the little-known alterations that take place. Very careful experiments, however, made both in an ordinary drier and in the laboratory, have revealed no difference in quality or colour between leaves dried in darkness and those dried in daylight or green light. It therefore seems unnecessary to illumine the drying apparatus with green light or to keep it in the dark as is nearly always done.

820 – **The Papaw and Papain.** — MACMILLAN, H. F., in *The Tropical Agriculturist*, Vol. XLIV, No. 3, pp. 179-184, 2 plates. Colombo, March 1915.

The writer gives some notes on the cultivation of the papaw tree and the preparation and commerce of papain.

The tree is best grown from seed and requires a moist tropical climate and a loamy soil. It begins to bear fruit at the end of the first year and continues without intermission until exhausted.

The latex is obtained by making light superficial incisions or scratches on the unripe fruit on the trees by means of a bone knife or other non-metallic instrument. The incisions should be not more than ¼ inch deep and ½ inch apart. The viscid juice is collected in enamelled or glass dishes, allowed to coagulate and dried rapidly in the sun. The incisions may be repeated at intervals of 2 or 3 days, but unless this is done carefully the fruits are liable to wilt and dry up. The best flow of latex is obtained in the early morning. When dry the product is packed in bottles or jars for export.

In Hawaii the yield is said to be about 1 lb. per tree per annum, but in Ceylon from ½ to ¾ lb. is considered a good yield. The clean product contains about 25 per cent of the active principle papain, but it is liable to adulteration with arrowroot starch, rice and wheat flour. In Montserrat (West Indies) special drying apparatus has been introduced, the latex being purchased from the natives.

The world's supply of papain comes largely from Ceylon and the West Indies, while America appears to be the largest consumer. A light-coloured product is in great demand in America, but it is difficult to procure since this is not its natural colour. The price of the raw product is from 6*s* 8*d* to 9*s* 4*d* per lb. in Ceylon, about 12*s* in Europe and from 7*s* 6*d* to 15*s* in the United States.

The total exports from Ceylon have increased from 6 611 lbs. in 1911 to 12 920 lbs. in 1912 and to 18 548 lbs, in 1913.

FRUIT GROWING

821 – **Citrus Culture in New South Wales.** — ALLEN, W. J. (Fruit Expert, Department of Agriculture, New South Wales). — *Farmer's Bulletin* No. 90, 96 pp., 31 figs., 20 plates. Sydney, 1915.

This bulletin gives a practical account of the cultivation (including propagation, pruning, manuring and irrigation) of citrus trees in New South Wales (Australia), with references to the practices in vogue in America and

Italy. The citrus trees dealt with are the orange, the lemon, the pomelo (grape-fruit), the lime, and the citron.

The varieties of oranges recommended are: Washington Navel, Golden Nugget Navel, Golden Buckeye Navel, Thompson's Improved Navel, Valencia Late, Mediterranean Sweet, Joppa, White Siletta, Parramatta, and Seville. Other varieties growing in the State include: Australian Navel, Navelencia, Groverly Navel, Maltese Blood, Paper Rind St Mihael, Homosassa, Jaffa, Holdfast and several varieties of Mandarins.

The handling and marketing of the fruit is described, with particulars of methods of curing lemons and the colouring of oranges and lemons by sweating. The manufacture of candied peel and marmalade is also described.

The bulletin concludes with an account of the insect, fungoid and other diseases of the trees and fruits.

822 – **Chemical and Biological Notes on Cherry Orchard Soils.** — HARVEY, A., and HOOPER, C. H. in *The Gardeners' Chronicle*, Vol. LVII, No. 1484, pp. 308-309. London, June 5, 1915.

An investigation into the chemical and physical composition of cherry orchard soils was undertaken with the idea of determining what constitutes the difference between those soils which are known to be favourable and those which are known to be unfavourable to the cherry crop.

Six cherry orchards were selected for the purpose and their soils were subjected to chemical and mechanical analyses, while detailed observations were made on the crop records and on the pollination of the trees. The analyses revealed no consistent differences of any kind between good and bad orchards, and it was evident that though favourable soil conditions influence the growth of a tree they do not necessarily affect its fruiting capacity.

As the cherry is a free-flowering tree, a failure to set fruit satisfactorily year after year would appear to be due, therefore, to lack of suitable cross-pollination rather than to some fault in the soil. And this view is confirmed by the fact that in one orchard several varieties cropped well, while one gave low yields, probably owing to the absence of any other variety capable of producing the required pollen.

It is recommended that in planting cherry orchards, several varieties be planted together and that these varieties be selected with due regard to their power of pollinising one another. In an established orchard where one or more varieties are cropping badly, trees known to be good pollinisers for the unfruitful variety should be introduced or regrafted in order to bring about suitable cross-pollination.

823 – **Philippine Dipterocarp Forests.** — BROWN, W. H., and MATHEWS, D. M., (Botanical Section of the Biological Laboratory of the Bur. of Science and Division of Investigations of the Bur. of Forestry, Manila, P. I.), in *The Philippine Journal of Science, Section A*, Vol. IX, No. 5-6, pp. 414-561, 12 figs., plates I-XIII. Manila, Sept. and Nov. 1914. FORESTRY

The fact that the dipterocarp forests are the most extensive and important forests of the Indo-Malayan region has been pointed out by a number of writers, but up to the present time little or no attempt has been

made toward an understanding of the factors influencing their growth and development. A clear comprehension of these factors is important from an ecological point of view, and is absolutely necessary if the forests are to be handled according to rational silvicultural practice. The need of such data has led the writers, one a botanist and the other a forester, to undertake the present study.

In the Philippines the dipterocarp forest would naturally occupy all of the best sites, but owing to the combined influence of man and climate it has been removed from considerable areas. This is especially the case in regions in which the dry season is pronounced. Owing to the fact that the forest occurs in dense stands of a few species which may be logged at a low cost, it is capable of furnishing large amounts of construction and finishing lumber.

The chief difference between the dipterocarp forest and a hardwood forest of the temperate zone lies in the several-storied arrangement of the former, with an accompanying greater density of foliage, and in the presence of a much larger number of minor tree species. Dipterocarp forests vary from dense stands in which the main story is composed entirely of mature and overmature dipterocarps to more open stands in which the main canopy may contain more individuals of other species than dipterocarps. The volume of a dipterocarp forest may be greater than that of an all-aged managed stand in Europe, but is usually less. When the volume is great its distribution is usually unsatisfactory from a management standpoint, as the bulk of it is contained in large mature and overmature individuals, the removal of which causes the destruction of the forest. If the dipterocarp forest is removed and the land is not cultivated, the forest is replaced by a non-commercial one of a totally different type, in which the trees are small, soft-wooded, rapidly growing species. If, after the removal of the forest, the land is cultivated and later abandoned, it usually grows up in grass, which maintains itself as long as it is burned over at more or less frequant intervals.

Dipterocarps growing in virgin forests in the Philippines undergo an extremely long suppression period. After this suppression period *Parashorea plicata* Brandis, the most rapidly growing dipterocarp measured, appears to grow about twice as fast as yellow poplar (*Liriodendron tulipifera* L.) in virgin stands. The average of the diptercarps measured shows rates of growth, after the suppression period, about equal to those of hardwoods in virgin forests in the central hardwood region of the United States. *Parashorea plicata* on Mount Maquiling (Laguna Province, Luzon), shows distinct seasonal rates of growth, there being two periods of slow and two of rapid growth. One period of slow growth coincides with the dry season, the other with the height of the rainy season when the sky is overcast for a large portion of the time. The temperature in a dipterocarp forest like that of Mount Maquiling is very uniform and not particularly high. The daily range is much greater in the dominant story than in the undergrowth. The humidity and soil moisture under the forest are always high and the rate of evaporation is low. The environment of the dominant story is much drier than that

the undergrowth. The rate of evaporation, even in the top of the dominant story during the dry season, is not high when compared with evaporation rates in deciduous forest regions in the United States. Environmental conditions in the forest are apparently favorable for growth throughout the year. The result is that such a dense vegetation is produced that the rate of growth of the individuals is greatly lowered.

The total growth of whole forests in the Philippines will in many instances be greater than that in a temperate hardwood forest, but the volume production of commercial timber will usually be lower. Clear cutting over large areas will, in most instances, eliminate dipterocarp species from any forests. Clear cutting on small areas will, in many instances, result in a satisfactory stand of dipterocarp reproduction. Selective cutting and culling, if not severe, will merely lower the volume production without seriously changing the species composition, but if continued over long periods will result in the elimination of all dipterocarp species which are cut. A partial cutting followed by a long period of closure seems to be the most satisfactory method of cutting over a dipterocarp forest.

Present experience seems to indicate that planting of dipterocarps will not be successful in open lands and probably only moderately successful in second-growth forests or in openings in the high forest. If planting is to be attempted in the Philippines at the present time, species which are easier to handle than dipterocarps and more valuable at maturity should be chosen. Heavy stands of dipterocarp forest which are largely overmature will have to be managed under some modification of the clear-cutting system. Those which contain distinct second and third stories composed partly of dipterocarps and partially of miscellaneous species can be most successfully managed under the shelter-wood system. Those in which there is a satisfactory distribution of dipterocarps throughout all size classes can be satisfactorily handled under either the shelter-wood system or the selection system with a diameter limit. Those which have been very heavily cut over under a diameter limit that was too low should be protected from all cutting until the small dipterocarps in the lower stories become large enough to bear seed.

824 – **Cultivation of the West Indian Cedar (*Cedrela odorata* L.).** — I. Notas sobre el Cedro Español. — *La Hacienda*, Vol. X, No. 7, pp. 198-200, 6 figs. Buffalo, N. Y., April 1915. — II. MARKLEY, H. H. Notas sobre el cultivo del Cedro Español. — *Ibid.*, No. 8, pp. 251-252, 8 figs. May 1915.

I. — It is generally believed that *Cedrela odorata* L. (Meliaceae), or West Indian cedar, is becoming scarce, but as a matter of fact there are still enormous reserves of this tree in the West Indies, Mexico and Central America. However, the increasing demand for the wood (1) renders it advisable to study the means of ensuring its production.

The West Indian cedar differs from mahogany, with which it is often associated, and which it closely resembles, in generally not extending

(1) Chiefly used for cigar-boxes, also for furniture; it is one of the most prized woods of tropical America. (*Ed.*)

higher than 750 m. (2 500 ft.) and preferring the river banks of the Atlantic slope of Central America and growing luxuriantly on ferruginous clays. In almost pure formation this tree can attain a height of 80 to 100 ft., with a diameter of 3 to 6 ft., the trunk being free from branches up to 15 or 20 ft. An average tree may be reckoned at 80 to 90 ft. high, with diameter of 3 to 4 ft., which would give nearly 250 cu. ft. of timber; taking trunks down to 16-inch diameter, the utilisable timber will average 50 to 70 cu. ft.; a tree may be considered ready for felling when it reaches 2 ft. in diameter. The weight of 1 cu. ft. of green timber scarcely exceeds 45 lbs. and seasoned timber comes down to 26 or 30 lbs.

II. — The writer gives the results of some trials of planting West Indian cedar as a paying project. The measurements given in Tables I and II were taken in a plantation in the State of Chiapas (Mexico).

TABLE I. — *Initial development of an individual tree.*

Age	Girth	Increase in girth	Height	Increase in height
	in.	in.	ft.	ft.
18 months	11	4	10	6
28 »	15		16	
4 years	22	7	—	—
5 »	29		—	—

TABLE II. — *Subsequent development of several trees.*

Tree	Age	Girth	Height of clean trunk
	years	ft. in.	ft.
1	23	10 1	22
2	»	10 2	30
3	»	6 5	30
4	»	6 8	24
5	»	6 1	32
6	15	6 7	22

In another plantation of nursery-reared trees, which were 12 inches high at transplanting and set 20 ft. apart, the girths at 27 years were 81 in. and 67 in. in two rows, average 74 inches. The whole plantation consisted of 300 trees estimated, at market price, as worth $10 000.

These satisfactory data show that commercial planting of West Indian cedar is possible. In fact a plantation of 20 000 nursery or sown trees (either alone or associated with castilloa or bananas), with the first cut at 15 years, might realise, at present prices, the sum of $500 000; further, it must be remembered that cultivating these trees on a limited area decreases the felling expenses by 50 per cent.

825 - ***Pinus pinaster* for Sowing on Peat Bogs in Ireland**. — MAC GREGOR, A., in *Irish Gardening*, Vol. X, No. 112, pp. 86-87, 2 figs. Dublin, June 1915.

Experiments on the afforestation of peat bogs in Ireland show that *Pinus pinaster* sown directly in the peat gives remarkably good results.

though the soil is fatal to Scots pine (*P. sylvestris*). It is probable that the maritime pine (*P. pinaster*) has not been in great favour on account of the difficulty of transplanting it. The seedlings resemble those of the Corsican and other pines in producing a long taproot and are therefore more suitable for direct sowing.

LIVE STOCK AND BREEDING.

826 - **Transformation of *Bacillus tuberculosis mammalis* into *B. t. gallinaceus.*** — ZWICK and ZELLER (Communications of the Sanitary Office), in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 23, pp. 268-269. June 10, 1915. HYGIENE

According to the recent researches of BANG and BONGERT, it is easy to effect the transformation of *Bacillus tuberculosis mammalis* into *Bacillus tuberculosis gallinaceus* by simply inoculating fowls with the *mammalis* type. The writers have studied this question experimentally by inoculating fowls either with cultures of this latter, or with emulsions made from infected organs. They used 100 fowls which were treated with bacilli obtained from horses, cattle, pigs and man respectively. In no case, not even when the conditions for the transformation were rendered more favourable by previous transmission of the bacilli through a rabbit, were the writers able to record the transformation of the *mammalis* type into the *gallinaceus* type. The same negative result was obtained on inoculating the lungs of numerous pigeons with bacilli of the *bovinus* type.

The experiments of the writers therefore do not confirm the results obtained by BANG and BONGERT.

827 - **A New Dipping Fluid.** — BRÜNNICH, J. C., and SMITH, F., in *Queensland Agricultural Journal*, Vol. III, Part 4, pp. 161-163. Brisbane, April 1915.

The undoubted extra efficiency imparted to arsenical solutions as toxic agents to the cattle tick by the incorporation therewith of tallow or oil soaps and Stockholm tar led to their general adoption in dipping fluids and to their inclusion in the dipping formula under the regulations of the Diseases in Stock Acts 1896-1898 of the Queensland Government. Tar and soap are the highest priced ingredients of dip mixtures and this has led to diminutions in the proportions used. The high price and difficulty of obtaining Stockholm tar of good quality led the writers to conduct experiments with commercial "bone oil" as a substitute.

This oil is a bye-product in the manufacture of bone charcoal and is procurable in sufficient quantities from sugar refineries. Experiments showed it to be in the main readily emulsifiable by boiling with alkali, and the resulting solution possessed marked detergent property and retained this in common with Stockholm tar when compounded with hard water.

Spraying and dipping experiments against ticks with bone oil at the rate of 1 gallon to 400 gallons of arsenical dip proved its total efficacy and showed a decided beneficial and emolient effect. The strong, though not objectionable, odour imparted by the oil leaves the animals in from 24 to

48 hours and is not communicated to the milk drawn from a milking herd subsequent to dipping.

The method of preparing the concentrate is as follows :

The bone oil is heated in an open pan with one-quarter its weight of caustic soda and stirred. After 15 minutes the heating is stopped and a dry intimate mixture of arsenic (4 parts) and caustic soda (1 part) is stirred into the oil in small portions. On cooling, sufficient water is added to make a soft homogenous paste which can be immediately dissolved in more water to produce the dipping fluid.

The following figures are the averages of several laboratory trials :

Bone oil	95	parts	by	weight
Caustic soda	25	»	»	»
Arsenic.	100	»	»	»
Caustic soda	25	»	»	»
Total . . .	245			

On cooling, the mass weighed 200 parts, so that 50 parts of water were added to make the final paste, which is used in the proportion of 1 part in 200 of water.

828 - **A Disease Resulting from Feeding Horses with Sugar or Molasses.** — SUSTMANN, in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 21, pp. 241-242. Berlin, May 27, 1915.

The writer observed early in the year in Germany that a considerable number of horses which had received a large ration of sugar or molasses (4 to 10 lbs. per day), in place of oats, went sick or even died. In several of these cases which he studied, he was able to record the presence of symptoms similar to those occurring in horses suffering from haemoglobinuria, but less severe than is usually the case in this disease, and accompanied by periodic paralysis of the intestine. Nevertheless, the writer believes that it is a question of the same malady.

The cause of haemoglobinuria is an excess of energy due, in the opinion of the writer, to an excessive ration of sugar, which is capable of giving rise to the disease even when the animal is regularly worked. Physiologically the occurrence of the complaint is to be explained by a more intense conversion of sugar into glycogen.

As regards the prevention and treatment of the disease, the writer recommends giving a much smaller ration of sugar and partially replacing this carbohydrate by grass, carrots, maize, etc. The ordinary method of gradually accustoming the horses to larger rations of sugar does not usually give good results. The sick animals were treated by Dr. Sustmann with 10.5 gms of " Digalen " (1) and with a mixture of 8 gms. calomel + 500

(1) " Digalen " is a 25 per cent solution of " digitoxine " in glycerine, " digitoxine " being one of the glucosides of foxglove (*Digitalis*). It is an effective substitute for the leaves of this plant, thanks to its rapid action and to the fact that the dose is capable of accurate estimation. (Cf. EUGEN FRÖHNER : *Arzneimittellehre für Tierärzte*, p. 15. Stuttgart, 1911). (*Ed.*)

gms. castor-oil; the former was injected subcutaneously, the latter ingested.

Before administering these remedies, the writer either gave the animals a dose of 0.3 gm. of morphine or bled them well. After this treatment the bowels were worked by introducing hot water (40° C.) into the rectum.

All cures were effected at the end of two hours.

820 – **Inquiry into Braxy**. — M' Gowan, J. P. (Royal College of Physicians' Laboratory, Edinburgh), in *Transactions of the Highland and Agricultural Society of Scotland*, Vol. XXVII, pp. 54-141. Edinburgh, 1915.

In 1888, from the stomach of sheep which had died of braxy, Nielsen isolated an organism which he considered to be the direct cause of the disease. His conclusions were later confirmed by Jensen and have since been accepted as established principles by the British Commission on Braxy, which published its report on the disease in 1906. As neither of the above investigators worked with fresh carcasses, but only with material which might well have undergone considerable change and contamination, their results were open to criticism, and in 1912 the writer initiated a new enquiry into the cause and distribution of the disease.

Post mortem examinations were carried out on sheep either immediately after or within a few hours of the death of the animals; from the lungs and heart blood was obtained an organism — *Bacillus bipolaris septicus ovium* — which reproduced exactly the symptoms of braxy when injected into rabbits and sheep. The organisms described by Nielson and Jensen were also found, but not on the perfectly fresh carcasses, and as the organisms in question are of a putrifying nature, it would appear as though they only developed as a result of an infection of the lesions after death. *B. bipolaris* belongs to the group of haemorrhagic septicaemia organisms which are normally present in the mouth and nose of the sheep, without, however, causing the development of braxy symptoms unless the vitality of the animal be lowered for some reason. These organisms are also capable of producing diseases resembling a milder form of braxy, such as are well known wherever braxy is prevalent, and it is suggested that these milder diseases serve to immunise the sheep against the more severe attacks of braxy itself.

As to the conditions under which *B. bipolaris* suddenly becomes virulent, the enquiry revealed the fact that there was an intimate relation between the occurrence of hoar forst and the appearance of the disease. It would seem as though the sudden cooling which occurs when a frosty night follows a spell of damp weather causes a severe chill to the animal body resulting in the development of braxy. The enquiry showed further that the disease was almost entirely confined to sheep in a thriving condition which had access to rank, succulent herbage.

Until further experiments have been made, treatment by means of a vaccine prepared from *B. bipolaris* is not recommended, but it is urged that measures should be taken to prevent sheep from eating rank succulent food when it is covered with hoar frost.

ANATOMY AND PHYSIOLOGY

830 - **Butter Fat in Relation to Animal Growth** (1). — I. OSBORNE, T. B., and WAKEMAN, A. J. (Connecticut Agricultural Experiment Station): Does butterfat contain nitrogen and phosphorus? — *The Journal of Biological Chemistry*, Vol. XXI, No. 1, pp. 91-94. Baltimore, Md., May 1915. — II. MC COLLUM, E. V., and DAVIS, M. (University of Wisconsin): The influence of certain vegetable fats on growth. — *Ibid.*, pp. 179-182.

I. — Butterfat, when fed to young animals, provides some vital and indispensable constituent which promotes growth. This constituent is absent in many other fats and various attempts have been made to isolate it and to determine its nature. To this end, samples of the centrifugated butterfat, similar to those used in the feeding experiments, were examined for nitrogen and phosphorus. Only the merest traces of both these elements were found and if the growth-promoting substance does contain nitrogen or phosphorus, it must be present in such small amount as to make its isolation impossible. It would appear more probable, however, that the traces of nitrogen and phosphorus are impurities derived from residues of the butter-milk, and consequently in future investigations on the nature of the growth-promoting substance, all those compounds containing nitrogen or phosphorus may be excluded from the list of possibilities.

II. — The constituent of butterfat which promotes growth in young animals has also been shown to be present in other fats of animal origin, but its existence in fats and oils of vegetable origin has not yet been demonstrated. A series of experiments was therefore carried out to determine the effect of fats contained in cereal grains in restoring to health and normal growth rats which had been brought to a condition of emaciation and great feebleness by prolonged feeding on a fat-free diet.

Maize meal and wheat embryos added to the diet at the rate of 50 per cent of the whole, caused emaciated rats to recover promptly and to assume a normal, well fed appearance. On the other hand, a diet containing 50 per cent of whole wheat meal, though it prevented the death of the enfeebled animals, did not cause growth to be resumed. Neither did the addition of rye or rolled oats to the daily rations seem able to supply the necessary amount or growth-promoting substance, though in these cases it is possible that the rats were in too low a condition to admit of recovery with the very small quantity of growth-promoting substance present in these grains.

The experiments further showed that an addition of 50 per cent of maize to the ration was more effectual than 5 per cent of butterfat in causing resumption of growth. Yet animals which had undergone a perfectly normal development on a complete diet could not be maintained in such a state when the fat-containing matter in the complete diet was replaced by only small quantities (5 per cent) of either maize or wheat.

Enfeebled rats were also given dried pig heart and dried pig kidney as a source of fat. While the latter proved most efficient in causing a prompt resumption of growth, the former only afforded a very temporary benefit to the rats.

The experiments are being continued.

(1) See also *B.* Oct. 1913, No. 1171; *B.* Feb. 1914, No. 142. (*Ed.*).

831 – **Comparative Researches into the Composition and Digestibility of Fresh Grass and of Hay dried naturally and artificially**. — HONCAMP, F. (Rostock Agr. Expt. Station), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XXXVI, Part III-IV, pp. 215-276. Berlin, 1915.

The question of the nutritive value of fresh grass in comparison with the same grass in the state of hay has already been treated by several writers, but not in a sufficiently exact and thorough manner. The writer therefore commenced a series of analytical researches in conjunction with digestibility experiments on sheep. He also used, for the first time, hay dried in vacuum, that is to say, without losses other than moisture.

Digestibility of vacuum-dried hay in comparison with sun-dried hay and with fresh grass. — It would seem from a preliminary series of researches that fresh grass and the resultant hay obtained by rapid desiccation in a vacuum apparatus have practically the same digestibility, while in naturally dried hay the digestibility is less (see Table I).

TABLE I. — *Comparative digestibility of fresh grass, hay dried in the sun and vacuum-dried hay (in average percentages of the different nutritive constituents)*.

Forage	Dry matter	Organic matter	Crude protein	N-free extract	Crude fatty matter	Crude fibre
Fresh grass	68.6	73.5	73.4	76.3	66.8	69.2
Hay dried in sun	67.0	71.0	69.6	71.1	68.4	72.6
Hay dried in vacuum	69.0	73.6	73.3	75.0	66.8	72.4

Composition and digestibility of fresh grass and of sun-dried hay. — The second series of researches, confirming the practically equal digestibility of fresh grass and of vacuum-dried hay, was chiefly devoted to the nutritive losses occurring in hay dried under natural conditions (see Table II).

TABLE II. — *Composition and digestibility of fresh grass and of natural hay (in percentages of dry matter)*.

Forage	Crude protein	Crude fatty matters	N-free extract	Crude fibre
Fresh grass:				
gross constituents	15.75	3.58	40.75	30.75
digestible constituents	12.00	2.31	25.67	20.76
Sun-dried hay:				
gross constituents	12.21	2.82	40.02	30.30
digestible constituents	7.61	1.53	28.16	18.97

Amongst other points should be noticed the loss in crude protein in natural hay.

The general results of this series of experiments may be summarised as follows :

1. The ordinary drying of grass in the air and sun is always accompanied by loss of nutritive substances, even apart from possible mechanical loss. What these particular substances are will depend upon the manner and general course of the drying.

2. In any case, the crude fat content and its digestibility are unfavourably influenced by drying the hay in the air and sun ; this is very probably due to the fact that when grass is dried in the sun, certain substances very soluble in ether and probably easy of digestion are entirely decomposed, or at any rate converted into compounds that only dissolve with difficulty and consequently are indigestible.

3. The apparent lesser digestibility of the N-free extract may be attributed to the processes of respiration and oxidation which are still going on at the beginning of the drying period. It is these processes which are chiefly responsible for the decomposition of the very soluble, and therefore easily digested, carbohydrates.

4. It appears to be proved that, under certain conditions, losses in nitrogenous substances may occur even during the ordinary drying of hay.

Composition and digestibility of hay dried by natural and artificial means. — In an initial series of experiments a comparison was made between natural hay and hay dried rapidly at a low temperature in the apparatus of a manufactory of chemical products. In another series natural hay was compared with hay dried artificially by treatment under heat. In the first case the chemical composition of the two products was much the same, though the artificially dried hay was less digestible, as is shown by Table III.

TABLE III — *Digestibility of natural hay and of hay dried artificially at a low temperature* (*in average percentages of the different nutritive constituents*).

Forage	Organic matter	Crude protein	N-free extract	Crude fatty matter	Crude fibre
Natural hay	63.3	62.3	65.8	54.9	60.5
Hay dried artificially at low temperature	59.6	61.0	58.4	53.1	61.7

In the second case, the results were still more unfavourable, as can be seen by reference to Table IV.

TABLE IV. — *Composition and digestibility of natural hay and of hay dried artificially at high temperature (in percentages of dry matter).*

Nutritive constituents	Hay dried naturally in the sun.		Hay dried naturally at high temperature	
	Gross constituents	Digestible constituents	Gross constituents	Digestible constituents
Crude protein	11.25	7.23	9.88	4.89
N-free extract	50.14	34.70	50.49	36.05
Crude fatty matter	2.42	1.43	3.26	2.16
Crude fibre	26.52	15.30	26.59	15.58

The results of the last series of experiments may be summarised as follows :

1. Artificial drying of grass at a low temperature, if the necessary precautions are observed, causes no noticeable loss of crude digestible substances.

2. Artificial drying of grass by means of the action of air heated by direct fire, as is the case in the ordinary drying apparatus, is always accompanied by a somewhat noticeable decrease in the digestibility of the protein.

832 – **Dried Yeast as Food for Farm Stock** (1). — CROWTHER, CHARLES (Department of Agriculture, University of Leeds), in *The Journal of the Board of Agriculture*, Vol. XXII, No. 1, pp. 1-9. London, April 1915.

With the object of gaining direct experience of the qualities of dried yeast as a foodstuff, observations and experimental tests with cows and pigs have been made at the Manor Farm, Garforth (University of Leeds Experiment Station) during the past winter. The material used was of a powdery or flaky consistency, light to medium brown in colour, with an agreeable smell and a bitter taste disliked by cows. The composition of the material was as follows :

	per cent
Moisture	10.9
Crude albuminoids containing 7.7 % of N.	48.3
Oil	0.5
Crude fibre	1.6
Ash	8.1
Soluble carbohydrates.	30.6
	100.0

Experiment with cows. — Two lots of four cows each of similar lactation periods were fed during four periods of three weeks with the following rations :

(1) See also *B.* Feb. 1915, No. 204 and footnote. (*Ed.*).

Period	Average rations per cow per day	
	Group I	Group II
1	7 lbs. cake (1)	7 lbs. cake
2	7 lbs. cake	4 lbs. cake 3 lbs. yeast
3	4 lbs. cake 3 lbs. yeast	7 lbs. cake
4	7 lbs. cake	4 lbs. cake 3 lbs. yeast.

(1) The cake used was a mixture of linseed and cotton cake.

The test was thus a comparison of the relative merits of 3 lbs. of cake and 3 lbs. of yeast, the introduction of the latter increasing the cost of the rations by 0.6*d.* per cow per day. The difficulty of the objectionable taste was overcome by the addition of a little treacle. The cows were milked twice daily and the results recorded separately for the four periods. Owing to the small number of animals and small differences obtained no safe conclusion could be drawn, although there was an indication that the yeast was to some extent superior to the cake. There was no indication of any marked difference in the fat content of the milk during the different periods.

The cows were weighed at fortnightly intervals throughout the experiment, and showed a steady gain of weight throughout with a slightly increased rate during the "yeast" periods.

Experiment with pigs. — Two lots of 10 pigs twelve weeks old were selected, but owing to deaths and the elimination of unsuitable animals group I was reduced to 3 males and 3 females. The plan of the experiment was similar to the preceding one with cows, the yeast being introduced into the rations of each group in successive 3-weekly periods during 15 weeks. The basal rations consisted of wheat "sharps", bran, barley meal, maize meal and a little treacle, with the addition of a little ground chalk. In every case where yeast was given, it replaced an equal weight of "sharps". During the early periods the growth of the pigs was unsatisfactory, but improvement began on removal to more commodious quarters.

The average gains for the yeast lots in each period are higher than the corresponding gains of the no-yeast lots. The average weekly gain throughout the experiments was 6.13 lbs. per pig for the yeast rations and 4.72 lbs. per pig for the rations without yeast; against this must be set the increased cost of feeding the yeast, which amounted to 1.18 *d.* per pig per week.

Thus the extra live-weight obtained by using yeast was secured at a cost of $^4/_5$ *d.* per lb.

It is concluded that dried yeast at present prices (£9 5*s* per ton) constitutes a very useful food for pigs as a supplement to the more starchy foods commonly given.

833 – **Reorganisation of the Stock-Breeding Department in Brazil.** — I. *Diario Official, Estados Unidos do Brazil*, Year LVI, Nos. 17, 29 and 31. Rio de Janeiro, January 20, February 3 and 5, 1915. — II. *Bulletin du Bureau de Renseignements du Bresil à Paris*, No. 33, pp. 3-19. Paris, June 15, 1915.

I. — REORGANISATION OF THE DEPARTMENT OF PASTORAL INDUSTRY. Decree No. 11460, under date of January 27, 1915 (*Diario Official*, February 5, 1915).

The Administration of the Veterinary Department has been reorganised under the name of the Department of Pastoral Industry. The objects of this Department are :

1) The administration and study of all questions relating to stock-breeding and the improvement of breeds.

2) Researches dealing with the feeding of live stock and forage analysis.

3) The instruction of breeders in the most up-to-date methods of stock-breeding possible in Brazil.

4) Researches regarding the acclimatisation and propagation of stud animals.

5) Assisting breeders with regard to the improvement of local breeds by advising them as to the most suitable stud animals.

6) The study of the best methods of storing and transporting animal products and particularly of those relating to milk products.

7) The study of the diseases of forage plants and the methods of their control.

8) The organisation of shows and competitions for live stock.

9) The reorganisation of statistics dealing with all branches of stock-keeping and breeding and the manufacture of animal products.

10) The medical inspection of imported and exported animals.

11) The medical supervision of the inter-State traffic or trade in live stock, by sea, river or land.

12) Scientific researches into the diseases of live stock.

13) The preparation of biological products (serums, vaccines, etc.) used for the prophylaxis of diseases of stock.

14) The administration and organisation of prophylactic measures for the suppression of epizootic diseases.

15) The treatment of enzootic and epizootic diseases.

16) The immunisation of imported animals.

17) The sanitary inspection of model slaughter-houses and cold storage depôts, subsidised by the Union, of the cattle entering the above and also of subsidised stock-breeding establishments, dairies, fairs or shows.

18) The free distribution to agriculturists and stock-breeders of biological products for prophylaxis of diseases of live stock.

19) The spreading of practical knowledge of veterinary science.

20) Information concerning the diseases of stock and measures for their prevention and cure.

21) Information regarding the hygiene of domestic animals.

22) Free treatment for live stock at the Veterinary Hospital.

23) The inspection of wintering-sheds for cattle.

24) Measures for the control and prevention of ticks and other external animal parasites.

25) The inspection of ports and of factories of animal products intended for sale to other States or Countries.

The Department includes: a directing Board in the Federal capital, zootechnical stations, model ranches, veterinary inspectors, veterinary stations and posts of observation throughout the States.

The Directing Board consists of three sections :

1) A stock-breeding section concerned with the compilation and distribution to breeders of publications and practical information, also with the collection of information as to breeds of stud animals, the organisation of fairs, shows, etc.

2) A veterinary section concerned with the performance of all measures connected with sanitary inspection and animal hygiene, with the preparation and distribution of serums, vaccines and other biological products, the inspection of ports, manufactories of animal products, the transport of animals by rail, the disinfection of trucks, etc.

3) An administrative section.

The area administered by the Department of Pastoral Industry is divided into ten districts of Inspection, distributed as follows :

1) Amazonas, Para and Maranhão (centre at Belem) ; 2) Piauhy and Ceará (centre at Fortaleza) ; 3) Rio Grande do Norte, Parahyba and Pernambuco (centre at Recife) ; 4) Alagôas, Sergipe and Bahia (centre at Bahia); 5) São Paulo and Matto Grosso (centre at São Paulo) ; 6) Minas Geraes and Goyaz (centre at Uberaba) ; 7) Rio de Janeiro and Espirito Santo (centre at Campos) ; 8) Paranà (centre at Ponta Grossa) ; 9) Santa Catharina (centre at Florianopolis) ; 10) Rio Grande do Sul (centre at Santa Maria da Bocca do Monte).

At the head of each of these districts is a Veterinary Inspector, aided by as many veterinaries and assistants as he requires. Each District is to possess bacteriological laboratories, the means for the maintenance of a veterinary hospital, sanitary inspectors and also a library dealing with veterinary science and animal hygiene which can be consulted by breeders and other persons interested. There is also to be a free information bureau and a department for the distribution of serums, vaccines and biological products.

Veterinary inspection of ports. — The inspection of imported animals devolves upon the port veterinary inspectors. The following diseases are regarded as contagious :

Cattle plague, or contagious typhus in all ruminants — Contagious pleuro-pneumonia in cattle — Mange and scab in sheep and goats — Foot-and-mouth disease in cattle, sheep, goats and pigs — Glanders (internal and cutaneous forms) in horses, donkeys and their hybrids — Rabies and anthrax in all species — Symptomic or emphysematous anthrax in cattle — Measles and pneumo-enteritis in pigs — Pyroplasmosis and trypanosomiasis in cattle, horses and dogs — Tuberculosis in all species — Fowl cholera.

No animal suffering from a contagious disease or suspected of conveying infection is allowed to enter a Brazilian port or to cross the frontiers ;

the same rule applies to their hides and other products, and also to forage from infected countries where there are no measures dealing with the veterinary supervision of live stock. It is further extended to any object which may have been in contact with sick or suspected animals and might be a means of spreading infection.

Importation of animals. — The importation of animals is subject to the following conditions :

a) The presentation to the port inspector, by the owner or his representative, of the animals' health certificate; this certificate must have been given by a competent authority and certify that during the thirty days preceding embarkation no contagious disease has been recorded in the zone from which the animals have come.

b) The presentation of the official certificate certifying inoculation with tuberculin in the case of cattle and with mallein in that of horses and mules.

c) Veterinary inspection of animals for a certificate of soundness.

d) Submission, when necessary, to any preventive measures directed by the Department, including inoculation with tuberculin and mallein.

For the registration of stud animals for breeding purposes evidence of pedigree is necessary.

Animals suspected of infection are to be re-exported, or placed under observation in a veterinary hospital. All animals, forage and any object that may have been in contact with suspected individuals are also to be placed under observation and subjected to prophylactic treatment.

Herds intended for the stall and considered as suspect are to be re-exported, or slaughtered ; in the case of bubonic plague, they are to be slaughtered and burnt.

Animals for breeding purposes regarded as suspect are to be quarantined for a period corresponding to the incubation period of the disease.

If the post mortem examination of the slaughtered animal does not reveal the lesions, or characteristic pathological symptoms, of the disease from which it was supposed to be suffering when slaughtered, the owner shall be entitled to compensation not exceeding the value of the animal and of the articles destroyed, provided that all the importation conditions have been observed. Should the post mortem confirm the diagnosis, the owner is entitled to no such compensation.

In the event of the post mortem results being contested, the owner may have another examination made by a veterinary surgeon of his own choice; in case of disagreement, the two experts shall select an arbiter to decide the matter.

Foreign cattle may only be imported at the frontier Customs offices, or at one of the following ports: Belem, SanLuiz, Fortaleza, Recife, San Salvador, Victoria, Rio de Janeiro, Santos, Paranaguá, Florianopolis, Rio Grande and Cuyabá.

The special work of the veterinary stations of the States shall be the study of the diseases attacking domestic animals, particularly tropical diseases, the organisation of prophylactic measures, the diffusion of practical veterinary knowledge, the free distribution of serums and vaccines, the establishment of infirmaries for the internment of infected animals, the

organisation of medico-veterinary supervision in breeding establishments and dairies in conjunction with the proprietors of these establishments, etc.

In addition to veterinary stations, the Government is to establish posts of observation at ports and at those places on the frontier which are set apart for the export and import of live stock and also at the wintering stations and frontiers of the States. These posts of observation are intended for the inspection of animals in transit, the isolation of suspected animals, and the slaughter of those suffering from contagious diseases, etc.; further, they are to afford breeders every facility for dipping their animals.

Finally dairy inspectors are to visit the principal factories of dairy products, as well as breeding establishments, in order to give instruction in the best methods.

The Direction of the Department of Pastoral Industry shall publish either quarterly or monthly a review entitled "Revista de Veterinaria e Zootechnia" with the object of popularising useful practical knowledge regarding veterinary science and stock-breeding. This review is to be distributed gratis to breeders and persons occupied in rural industry and to other persons interested.

II. — Registration of Pedigree Stock. — Decree No. 11425 of January 13, 1915 (*Diario Official*, January 20, 1915).

The Department of Agriculture is charged with the registration of stud animals, whether cattle, horses, sheep or pigs, imported from abroad or born and reared in Brazil. On the register are to be entered the name, nationality, parentage, age, coat colour, marks and other characteristics of the animal, as well as the name of its owner. This Register is to consist of eight special books, *viz.* two Studbooks, two Herdbooks, two Flockbooks and two Pig-books: one of each category for native and one for foreign breeds.

Animals are considered as Brazilian if they have been born and reared on Brazilian territory. As regards foreign breeds, only pure-bred animals are eligible for registration. On the native register no animals shall be eligible which are of a lower class than half-breds.

The Federal Government, in order to encourage progressive selection of the national herd, and to afford breeders ample facilities for obtaining testimony as to the parentage and descent of their animals, shall endeavour to make arrangements with rural associations or groups of associations and with the Municipal bodies, for the institution, in the different localities, of regional or local registers on the same plan as the general register.

The certificates or extracts from these registers given by the above Associations shall be accepted as valid; registering and furnishing certificates for pure-bred stud animals imported from abroad is reserved to the Union.

On July 1st and December 31st of each year, the Department of Agriculture shall cause to be published in the *Diario Official* a report on the registration of foreign stud animals effected in the course of the preceding half-year.

The entry of the national stud animals in the general register of the

Department of Agriculture shall take place on the official communication of a certificate of registration in the local registers kept by the bodies duly authorised.

Only such animals as are entered in the registers may compete for money prizes at shows.

A report on the registration of animals shall be published each month in the most important newspaper of the district. An extract from the register of native animals shall be published on July 1st and December 31st of each year in the *Diario Official*.

III. — Regulation of the Federal Stock-breeding Stations. — Decree No. 11461 of January 28, 1915 (*Diario Official*, February 3, 1915).

The Federal Stock-breeding Stations form part of the Department of Pastoral Industry. They are concerned with all experimental work capable of practical application, either direct or indirect, to the breeding industry of Brazil, particularly in those regions where the above-named Stations are situated. Their work is to cover the following ground:

1) Researches on breeding, particularly those having regard to the acclimatisation and adaptation of different breeds of cattle either for draught purposes or for meat and milk production. Their duties also include giving information upon breeding methods, fattening, the milk industry and the care of animals.

2) Encouraging the acclimatisation and propagation of pure-bred animals.

3) Facilitating the breeders' work of improving local breeds by supplying the most suitable stud animals.

4) Encouraging the selection of the best national breeds.

5) The establishment of a register for animals of the Stock-breeding Stations.

6) Instructing breeders in animal hygiene, feeding and housing, the value of forages, etc.

7) The study of forages from the agricultural, chemical and economic points of view, with particular regard to national products.

8) The study of the parasites and diseases attacking live stock, their prevention and treatment.

9) The practical study of dairy processes.

10) The analysis of soils, seeds, fertilisers, fodder, animal foodstuffs, etc.

11) Holding practical courses in stock-breeding, veterinary science and dairying.

12) Consulting with breeders.

At each Federal Stock-breeding Station, practical and elementary courses of instruction for adults shall be held on the following subjects, the courses covering a period of three months: stock-breeding and veterinary science, dairy-work, agrostology.

In order to be admitted to these various courses a person only requires to be above 14 years of age and to possess a certificate of primary education. The Stock-breeding Stations will be able to receive a certain number of non-paying apprentices chosen principally from the sons of agriculturists and breeders.

At both the ordinary and travelling Stations, practical lectures will be held periodically for the benefit of agriculturists and breeders.

CATTLE

834 – **The Relation of the Quality of Proteins to Milk Production.** — HART, E. B., and HUMPHREY, G. C. (University of Wisconsin), in *The Journal of Biological Chemistry*, Vol. XXI, No. 2, pp. 239-253. Baltimore, Md., June 1915.

When compounding rations for milch cows according to a given albuminoid ratio, the nitrogenous portion of the different ingredients is estimated merely as "total digestible protein", irrespective of the quality of the different protein substances involved. There is evidence, however, that the quality of the protein fed may play an important part in the subsequent processes of animal metabolism. Some experiments were therefore carried out to determine whether proteins from different sources varied appreciably with regard to their power of supplying the necessary proteins for milk production.

Three cows were fed for periods of ten days at a time on diets containing an equal amount of digestible protein derived from one of three sources: wheat, maize or milk. In the case of each animal a period on the "milk" ration was alternated with a period on the "wheat" and a period on the "maize" ration. The intake and output of nitrogen was recorded. It was found that while a balance of nitrogen was retained in the body during the milk ration period, the body lost nitrogen during the wheat and maize ration periods. During the latter periods, tissue autolysis occurred and there was no decrease in the milk proteins elaborated.

The results indicated clearly that the quality of the proteins is an important factor and that the synthetic powers of the mammary gland cannot compensate for deficiencies in protein structure. Were the nature of the proteins in each food known, this would doubtless lead to economy in feeding, as the albuminoid ratio could be varied according to the efficiency of the protein employed.

835 – **Comparative Feeding Trials with Milch-Cows, using Rape Cake, Palmnut Cake and Fresh Brewers' Yeast.** — RENNER, V., in *Landwirtschaftliches Jahrbuch für Bayern*, Year 5, No. 2, pp. 119-144. Munich, 1915.

The author has endeavoured to determine the influence of fresh brewers'-yeast on the milk production of cows and the quality of the milk and butter, in comparison with the influence of rape and palmnut cakes. For his experiments he employed two groups of 13 cows, all belonging to lowland breeds with the exception of one Simmenthal in each group. The cows had been bought after calving, and from the day of purchase to the beginning of the experiment (1st November 1912) about 171 days had elapsed for group A and 169 for group B. The basal ration was identical for the two groups; in addition, group A, during the whole period of the experiment, received 5.06 lbs. of rape cake per head per day, while the experimental feeds added to the basal ration of group B were as follows:

Trial Periods	Feeds
I	5.06 lbs. rape cake.
II	1.76 lbs. rape cake + 3.3 lbs. palmnut cake.
III *a*	1.76 lbs. rape cake + 25.08 lbs. fresh brewers'-yeast.
III *b*	37.84 lbs. fresh brewers'-yeast.
IV	5.6 lbs. rape cake.

The feeds were administered in two rations per day. After they had overcome their initial repugnance for the malt yeast poured over the basal ration of dry feed, the cows ate with good appetite. They were milked three times a day and the average daily yields per cow are given in the following table:

TABLE I. — *Average daily milk yield per cow.*

Periods		Experimental feeds with group B	Daily milk yield per cow in pounds		
No.	Duration		Group A	Group B	B more (+) or less (—) than A
	1–5. XI.	Transition	28.55	27.54	— 1.01
I	6–25. XI.	Rape cake	28.73	27.69	— 1.04
	26–30. XI.	Transition	27.32	26.90	— 0.42
II	1–11. XII.	Palmnut cake	27.76	27.19	— 0.57
	12–19. XII.	Transition	27.96	28.09	+ 0.13
III*a*	20–29. XII.	Brewers'-yeast (light ration)	27.80	28.24	+ 0.44
	30. XII.–3. I.	Transition	27.52	28.55	+ 1.03
III*b*	4–18. I.	Brewers'–yeast (heavy ration)	27.91	29.23	+ 1.32
	19–23. I.	Transition	27.89	27.74	— 0.15
IV	24. I–7. II.	Rape cake	27.10	26.09	— 1.01

TABLE II. — *Changes in the quality of the milk.*

Périods	Specific gravity		Fat		Total solids		Solids-not-fat	
	A	B	A	B	A	B	A	B
			%	%	%	%	%	%
I and IV.	1.0330	1.0326	3.26	3.23	12.42	12.28	9.16	9.05
II.	1.0330	1.0324	3.21	3.31	12.39	12.34	9.16	9.03
III*a*.	1.0327	1.0327	3.27	3.25	12.36	12.34	9.09	9.09
III*b*.	1.0330	1.0331	3.24	3.37	12.40	12.58	9.16	9.21

No increase in the milk yield due to the palmnut cake can be detected by examination in either of the two groups taken as a whole or in the single group B. taken from period to period. There can be no doubt, however, as to the increased yield resulting from the brewers' yeast.

Table II shows the changes which occur in the quality of the milk.

Here the palmnut cake shows its characteristic effect of increasing the fat content of the milk. During the period of feeding with brewers' yeast the specific gravity rose a little, the content in solids-not-fat increased, as did also the fatty matter during the period of the heavy ration. It is difficult, however, to decide whether this is due to the brewers' yeast or to the absence of rape cake, which is known to have a tendency towards diminishing the fat content of milk. In any case it may be said that the effect, if indeed there be any, of brewers' yeast in increasing the fat content is only very slight.

As regards the changes in the quality of the butterfat resulting from these different feeds, the following facts have been established: The butter derived from the milk of cows fed on rape and palmnut cakes was white, whereas that from cows fed on brewers' yeast was yellow. The "rape-cake butter" at a temperature of 18° C. was soft, it lost all shape and remained adhering to the sides of the glass vessel; the "palmnut-cake butter", on the contrary, and also that resulting from the brewers' yeast, were, at the same temperature, firm, retained any shape imparted to them and did not adhere to the sides of the vessel.

The writer has also determined the solidifying point, the iodine number according to Hübl, the saponification value according to Koettstorfer and the Reichert-Meissl number; these data are given in Table III.

TABLE III.

Periods	Solidifying point		Iodine number		Saponification value		Reichert-Meissl number	
	A	B	A	B	A	B	A	B
I	17.9° C	17.9° C	36.14	34.71	228.2	228.8	28.30	28.38
II.	—	—	39.40	32.67	223.5	229.0	—	—
III*b*	17.9° C	19.2° C	42.07	34.21	220.9	227.6	25.44	26.89

The value arrived at in this experiment for the brewers' yeast, calculated on the basis of a daily milk yield of 21.47 lbs. per cow and an increase in live-weight of 5.15 oz. per day was 3.4 pf. per kg. (0.18*d* per lb., or 1*s* 8*d* per cwt). This calculation is based on the following values: 18 pf. per kg. (1*d* per lb., or 9½*d* per gal.); live-weight 70 pf. per kg. (3¼*d* per lb.); rape-cake 12.50 marks per quintal (6*s* 3*d* per cwt.).

PIGS

836 - **Feeding Pigs on Straw Meal: Experiments in Germany.** — BRAHM; VON DER HEIDE; and ZUNTZ: — *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 16. Berlin, 1915.

The writers used in their experiments two kinds of straw meal, of which the composition is given in Table I.

TABLE I. — *Composition of two kinds of straw meal.*

Constituents	Meal No. 1	Meal No. 2
	per cent	per cent
Crude protein	3.42	8.59
Fatty matter	2.09	2.75
Crude fibre	27.30	12.46
N-free extract	58.80	62.16

Meal No. 2, which contained a large amount of ground grain, cannot be considered a true type of straw meal.

When fed, the straw meal was mixed with gluten, sugar, molasses or skimmed milk, that is to say, with substances that were almost entirely digestible. The digestibility of the straw meal was calculated on the basis of a digestibility coefficient of 90 per cent for the gluten and milk protein and of 100 per cent for the sugar (see Table II).

TABLE II. — *Digestibility of the two kinds of straw meal.*

Constituents	Meal No. 1		Meal No. 2
	as fine dust	less fine	
	Per cent.	Per cent.	Per cent.
Protein	1.46	1.99	1.54
Fatty matter	0.45	0.28	0.92
Crude fibre	1.47	3.79	0.00
N-free extract	17.08 (=61.4 gr. cal.)	9.20 (=31.9 gr. cal.)	21.40

In accordance with the loss of nitrogen due to the straw and recorded in the faeces, there was a deficit in the balance of nitrogen in the feeding experiments; in the first experiment, which lasted 5 days, the loss was 17.3 gms; in the second, which was continued for 6 days, it amounted to 21.6 gms.

Experiments with the respiration calorimeter proved that straw meal increases the work of digestion. By fermenting the fibre of straw meal by means of bacterial action, a very high digestive coefficient was obtained for this constituent, but in this experiment also the nitrogen balance showed a deficit.

The writers conclude that the results of their experiments do not warrant the adoption of this method of feeding.

837 - **Length of the Gestation Period in Yorkshire Sows.** — DASSOGNO, LINO, in *L'Industria lattiera e zootecnica*, Year XIII, No. 12, pp. 180-182. Reggio Emilia, June 15, 1915.

Examination of 176 cases in Yorkshire sows shows that the gestation period varies between 111 and 116 days; the usual average is 114 days and the interval between the longest time (128 days) and the shortest (106 days) is 22 days.

In addition to this fact, the establishment of which was the writer's chief object, it was discovered that the predominance of one sex in the offspring does not noticeably alter the length of the gestation period; nor has the size of the litter any influence upon it. This agrees with the opinion of Dr. SABATINI, who, basing his statement upon 1109 observations, denies that the gestation period of a sow is the shorter the larger the litter she produces. The writer ascertained further that the shape and weight of the young pigs were also without influence upon the length of the gestation period.

The length of the period does, however, vary with the age, vigour and general condition of the sow, and more especially with the more or less normal functioning of its ovaries.

POULTRY

838 – **Studies on the Physiology of Reproduction in the Domestic Fowl. — XIII. On the Failure of Extract of Pituitary Body to Activate the Resting Ovary.** — PEARL, R., and SURFACE, F. M. (Maine Agricultural Experiment Station), in *The Journal of Biological Chemistry*, Vol. XXI, No. 1, pp. 95-102. Baltimore, Md., May 1915.

Having shown in a previous paper that an extract from the corpus luteum of a cow would inhibit ovulation when injected into a fowl, investigations were initiated to discover a substance which would have the contrary effect and activate a resting ovary. An extract of the anterior lobe of the pituitary body of a cow was injected into fowls in various-sized doses during the period of moult, when the ovaries are known to be in a condition of complete inaction. In no case did the infection cause a hen to resume her laying activities immediately, and in some cases the resting period was even lengthened, possibly owing to the temporary physiological disturbance of a severe nature which followed the injection of the pituitary extract into the blood stream.

839 – **Eleventh Annual Egg-laying Competition in South Australia, 1914-15.** — LAURIE, D. F. (Poultry Expert and Lecturer), in *The Journal of the Department of Agriculture of South Australia*, Vol. XVIII, Nos. 9 and 10, pp. 741-747 and 870-877. Adelaide, April and May 1915.

The eleventh competition (held at Parafield) consisted of three sections: first, third and fourth, the second having been merged in the first.

Section 1. — Open to the world. The number of birds competing was increased from six to ten in a pen. Fifty-one pens were entered, including 49 pens of White Leghorns, and one pen each of Black Orpingtons and White Wyandottes.

In Sections 3 and 4, each pullet was separately housed under the single-testing method. Section 3 was limited to light breeds only, and there were 34 entries of six pullets each, all White Leghorns. In Section 4 (General Purpose Breeds) there were 25 entries (150 pullets). They included Barred and White Plymouth Rocks, Black, White and Buff Orpingtons, Silver and White Wyandottes, Rhode Island Reds, Langshans and Indian Game.

The total number of birds competing was 864.

In conformity with the regulations "any pens the eggs from which do

TABLE I. — *Summary of results.*

	Section 1	Sections 3 and 4
Number of hens	340	222
Total number of eggs laid	66 748	38 552
Total value of eggs laid	£280 13*s* 4*d*	£162 2*s* 2*d*
Total cost of feeding *	£127 17*s* 6*d*	£67 13*s* 6*d*
Profit over cost of feeding	£152 15*s* 10*d*	£94 8*s* 8*d*
Average number of eggs laid per hen	196.3	194.9 (Sect. 3) 135.9 (Sect. 4)
Average cost of food per hen	7*s* 6.3*d*	6*s* 1.16*d*
Eggs laid by winning pen	2 523	—
Highest average per hen	252.3	—
Profit over cost of food per hen	8*s* 11.81*d*	8*s* 6*d*
Eggs laid by winning hen Sect. 3	—	278
» » » » » Sect. 4	—	196

* Including food fed to disqualified birds and birds that died in Sections 3 and 4.

TABLE II. — *Comparison of the Series of Eleven Tests, made in South Australia, from April 1 to March 30, 1903 to 1915.*

Locality and date	No. of hens	Eggs laid	Average per hen	Eggs laid by winning pen	Cost of food per hen	Return per hen	Profit per hen
Magill 1903–4	156	20 630	132	1 032	7 9	9 11	2 2
Roseworthy 1904–5	186	21 701	117	1 251	3 1	6 3½	3 2
» 1905–6	186	31 962	171	1 343	4 11	10 7	5 8
» 1906–7	450	80 959	179.9	1 531	5 4½	11 10	6 5½
» 1907–8	336	63 818	190	1 447	5 9¾	13 10	8 0¼
» 1909–10	678	126 133	180	1 531	5 6½	13 10	8 3½
» 1910–11	534	102 723	192.3	1 513	5 10½	13 5	7 6½
» 1911–12	756	133 093	176.04	1 589	4 11½	14 4¾	9 5¼
» 1912–13	804	146 329	182	1 413	5 7.8	16 6	10 10.2
Parafield 1913–14	900	160 639	178.48	1 444	4 3.8	14 6¾	9 2.9
» 1914–15*	340	66 748	196.3	2 523	7 6.3**	16 6	8 11.7

* There were in each pen 10 pullets, as against six in the previous tests. — ** In 1914-15 the prices of poultry foods were very high.

not attain an average weight of 24 ozs. per dozen by July 31st will be ineligible to participate in the prize-money and will be returned to the owners".

A summary of the results obtained is given in Tables I and II.

During the 1914-15 tests several observations were made. Those on feeding showed the advantage of giving green food. The value of lucerne, both green and cured as hay, was better recognized; when it is used, the yolks of the eggs are always rich in colour. Grit is essential to success and consists of sharp gravel, shell grit and broken charcoal. The value of small charcoal for fowls is but ill-recognised by breeders. Charcoal should be freely provided at all times and ages. Salt, used with discretion, is good for fowls but not for ducks. Epsom salts (magnesium sulphate) and Glauber's salts (sodium sulphate) are of great value as aperients and correctives, even when green food is abundant.

In 1914-15 the food used by all the hens in the competition including those that were disqualified and those that died, was as follows:

	£	s	d
Wheat 199 $^{5}/_{6}$ bush.	47	2	4
Bran 135 $^{17}/_{20}$ »	9	11	2
Pollard 418 $^{1}/_{20}$ »	32	3	5
Meat meal 12 $^{1}/_{8}$ cwt.	11	4	4
Lucerne chaff 6 cwt. 63 lbs.	1	6	3
Grit 9 cwt 20 lbs.	1	2	4
Salt 48 lbs.	0	1	6
Oats 1 $^{1}/_{2}$ bush	0	6	0
Epsom salts 41 lbs.	0	0	6
£	102	17	10

In continuation of studies previously begun, no cases of broodiness were observed from April to August inclusively; in the other months there were a few. The pullets in Section 1 (almost all White Leghorns) showed a percentage nearly three times as great as those in Section 3. The writer considers broodiness as a distinct and hereditary character and that in White Leghorns it is the reappearance of a lost character—strictly speaking a masked character — to be eliminated at all costs. The best layers never exhibit a desire to brood. From long continued experiment and observation the writer has formed the opinion that broodiness is transmitted equally through both male and female lines and that non-broodiness is an ordinary recessive character.

Another character to be eliminated in White Leghorns is the tinted eggshell. This is due to products of hepatic origin secreted by certain glands of the oviduct. It would seem that this factor — the tinting of the eggshells-is affected by some seasonal influence, being much less marked during the warm weather.

It is now generally recognised that in order to have vigorous progeny only hens not younger than two seasons must be used.

It has also been proved that unless the male bird is the son of a hen

distinguished by high laying the pullets will, as a rule, be poor layers. It has likewise been seen that improvement in the size of the eggs can only be effected through the male.

840 – **Sex Ratios in Pigeons, together with Observations on the Laying, Incubation and Hatching of the Eggs.** — COLE, LEON J., and KIRKPATRICK, F., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 162, pp. 463-512. Kingston, R. I., April 1915.

The results presented in this paper have been obtained in the course of studies on inheritance in pigeons carried out at the Rhode Island Agricultural Experiment Station and at the Wisconsin Experiment Station.

Among 1648 birds hatched, the proportion of 105 males to 100 females, was obtained, thus confirming the observation made by practical pigeon raisers and by many writers that the males exceed the females in number, though the figures given by some observes report a greater exceess of males over females.

The death rate of squabs is especially high for the first two or three days after hatching and at about 10 to 15 days of age. From this second period the number of deaths drops again rapidly to about 50 days, after which there is a steady but slight decrease in the number of deaths for nearly six and one-half years (the duration of the experiments).

The causes of mortality are chiefly the following : lack of constitutional vigour, neglect on the part of the parents, specific infections and accidents.

When two squabs are of distinctly different size at the age of 10 to 15 days the larger squab is more often a male than a female.

In bisexual broods (that is in which one squab is male and the other female) the death rate for the two sexes is essentially equal and neither of the two has any marked tendency to be weaker than the other, and there is only a slight indication that more males than females from such broods survive to adult life — placed at 6 months.

There is a high mortality of both sexes during the first two or three years of their adult life, and this is especially high in the females between the ages of 1 and 2 years. On a total population of 244 males and 272 females, the mortality from natural causes was :

	Males per cent	Females per cent
between 6 months and 1 year	6.1	8.8
» 1 and 2 years	8.3	13.7
» 2 » 3 »	1.9	5.1

The higher mortality of females at early adult ages, together with the higher proportion of males hatched, may be responsible for the prevailing notion of a considerable excess of male pigeons in adult population and seems to confirm this notion.

In the records kept, the number of unisexual broods, in which the squabs are either both male or both female, somewhat exceeds the bisexual broods. Considering only the unisexual broods the number of " both females " to " both males " is practically equal.

A comparison of the numbers of each sex hatched from first eggs and from second eggs respectively shows no tendency for the former to produce exclusively males and the latter females, but as a matter of fact more males than females are hatched from both.

The mean time of laying the first egg is about 5 p. m. and of the second egg about 1 p. m. of the second day following. The mean interval between the laying of the two eggs is practically 44 hours; it decreases progressively in the months from February to July inclusive.

There is a very sensible positive correlation between the time of laying of the first and of the second egg. The formula

$$x = -0.48 + 0.378\ h,$$

in which h is the time p. m. of laying of the first egg and x that of the second, gives the most probable time of laying of the second egg when that of the first egg is known. This formula is based on all the available data and is not corrected for the different months.

The mean time of hatching of the first egg is 16.5 days after the laying of the second. The mean time of hatching of the second egg is 17 days after it is laid. On the average therefore the time from laying to hatching of the first egg is nearly a day and a half longer than it is for the second egg. This is probably to be accounted for by the fact that the first egg receives very little incubation until the second is laid. There is also a high correlation between the time of hatching of the two eggs of a clutch.

So far as the data presented go, they appear to indicate that sex in pigeons is determined according to the laws of chance.

A bibliography of 25 works is annexed to the paper.

BEES

841 – **A Method of Recording Colour Variation and of Investigating Inheritance in Honey Bees.** — GLADER, F. W. L., in *The Agricultural Gazette of Canada*, Vol. II, No. 6, pp. 515-518. Ottawa, June 1915.

For purposes of breeding work now being carried out in the apiary at the Central Experimental Farm, Ottawa, a new scheme of classification has been drawn up. The bees are divided into ten classes or "stages" according to the amount and distribution of the yellow colour on the abdominal segments. To indicate the "colour index" of a colony, a hundred workers are taken for analysis and a diagram is made showing the percentage distribution of the individuals among the different stages.

The colony from an impregnated Italian queen imported from Novara, and colonies from two of her daughters mated to local black drones, were examined on the above system and it was found that the progeny of an Italian queen mated to a black drone can be distinguished from that of an Italian queen mated to a pure Italian drone, by the darker colour of the workers. This conclusion is at variance with those of NEWELL (1), who states that "the purity of an Italian queen's mating cannot be determined by an examination of her workers".

(1) See *B.* April 1915, No. 416. (*Ed.*).

842 - **Observations upon the Variability in the Weight of the Larvae and Cocoons of *Bombyx mori*.** — PIGORINI, L., in *Informazioni seriche, Rivista dell'Industria bacologica e serica*, Year II, No. 11, pp. 275-282. Rome, June 2, 1915. SILKWORMS

In the course of his researches into the value of amido-acids in the feeding of silkworms and the physiology of nutrition, the writer had occasion to observe in certain batches the progressive occurrence of a more or less serious irregularity in the development of the individuals. In this article he gives a brief account, with the aid of figures and graphs, of his observations regarding the variations in weight of a brood of silkworms reared under normal conditions, or in circumstances showing a varying degree of abnormality. The fundamental fact observed was that, in this case, as in that of all other natural phenomena, the division of the individuals of a group by the gradation of certain characters follows Gauss's law. He determined the weight of the individuals of a small group of 75 normally reared silkworms and divided them into classes differing from one another by 1 decigram. In this way he obtained percentages showing that the variation as regards weight among a brood of normally reared silkworms follows the general law regarding the normal variation of individuals in respect of a given character.

The writer then proceeds to examine the modifications observed if the normal breeding conditions are altered by means of spraying the mulberry leaves given to the silkworms with various substances.

Experiments were made with normal leaves sprinkled with pure water and finally with those sprinkled with the solutions it was desired to test. The silkworms were of the Kasuri breed and had just completed their second ecdysis. The experiments demonstrated the following facts:

1) The type of curve of the groups fed on untreated leaves is normal, with one peak and small amplitude.

2) This type is more or less modified when the leaf is sprayed with water or with various solutions.

3) In the experimental batches, the disturbing causes produced effects which were cumulative and were not eliminated by the moults.

This cumulative effect of disturbing causes, which occurs also in the control groups, shows that it is necessary to disturb the insects as little as possible during the experiment; handling, weighing, delaying the feeding-time, or subjection to changes of temperature produce changes in the vital processes which do not affect all the individuals in the same manner.

Lastly, it was found that the arithmetical mean of the daily weighings cannot be taken as the index of the development of the individuals of a whole group, except in the case of normally reared broods.

FARM ENGINEERING.

843 - **Mechanical Tillage Experiments at Grignon, France, in 1914 and 1915.** — BRETIGNIÈRE and RINGELMANN, in *Le Progrès Agricole et Viticole*, Year 32, No. 23, pp. 532-536. Montpellier, June 6, 1915. AGRICULTURAL MACHINERY AND IMPLEMENTS

The experiments organised by the French Ministry of Agriculture, which were commenced in the autumn of 1913, have been continued,

notwithstanding some interruption due to the war, which has prevented the full programme (1) being carried out. The jury nominated by the Ministry met in March 1915 and adopted the report drawn up by the writers of this paper, and which contains the following conclusions, which, however apply only to the machines entered and to the conditions prevailing at Grignon :

The *C. I. M. A. tractor* (Compagnie internationale des machines agricoles de France) seems to be suitable for ploughing to a depth of 6 to 8 inches, but it compresses the headlands a good deal by its turning at the end of the furrow, and in certain soils, this may be a drawlack.

The *windlass tractor* (M. A. Bajac) is the most advantageous for heavy ploughing to depths beyond 12 inches and especially for subsoiling.

Stock's motor plough. As this outfit requires only one mechanic it is the most economical for ploughing up to 12 inches in depth. For deeper work it is not so advantageous as other systems. It is only suitable for ploughing wide ridges or lands.

The crops harvested from the plots ploughed by the various machines were as follows :

I. —*Grignon, Defonce field :* Shallow calcareous clay soil. After wheat, a catch crop of white mustard was sown and ploughed in by the various machines, one on each plot, while one plot was ploughed by a Flemish double turn-wrest plough drawn by oxen, after which Grey Houdan oats were sown on all of them.

The yields in pounds per acre are shown by the following table :

Crops	Flemish plough drawn by oxen	C. I. M. A. tractor.	Stock motor plough	Rotary diggers	
Straw	2750	3360	3360	2469	2542
Grain	2170	1948	2409	1753	1725
Chaff, etc.	491	803	661	326	491
Total	5411	6111	6430	4548	4758
Ratio Straw to Grain	127	173	130	141	147
Ratio Grain to Grain	100	100	100	100	100

In all the machine-tilled plots the ratio of straw to grain is greater than in the one ploughed by oxen.

II. — *Grignon, Quinze Arpents field :* Fairly deep loam. White Ligovo oats following lucerne. The yields in pounds per acre are shown in the following table :

(1) See *B.* May 1914, No. 457. (*Ed.*).

Crops	Flemish plough drawn by oxen	C. I. M. A. tractor	Bajac windlass tractor	G. Flitz tractor hauling on cable	Stock motor plough	Vermont Quellenec rotary digger
Straw.	3613	3379	3569	3212	2989	3345
Grain.	3256	3155	3279	2766	2632	3055
Chaff, etc.	580	625	578	647	635	647
Total.	7449	7159	7426	6625	6256	7047
Ratio { Straw . . .	111	107	109	116	115	120
Ratio { to Grain . . .	100	100	100	100	100	100

It will be seen that in this field and under the weather conditions of 1913-14 the plot ploughed by Bajac's tractor yielded a crop very similar, both for quantity and for ratio of straw to grain, to that obtained by the Flemish plough. The other plots yielded less and (except for the C. I. M. A.) with an inferior ratio.

III. — *Comparison of the results obtained in the two fields.*

In both fields the Vermont-Quellenec gave lower yields than the Flemish plough, while the results of the C. I. M. A. tractor and Stock's motor plough differ in the two fields.

In the *Defonce* field the crops were heavier than those obtained on the work of the Flemish plough, while in the other field they were inferior. This may be explained by the fact that in the *Defonce* field the ground was not too moist and it had been ploughed as well by the C. I. M. A. tractor as by the Flemish plough and decidedly better than by the Stock motor plough. In the C. I. M. A. plot the white mustard had been turned in better than by the Flemish plough. On the whole the plots ploughed by the C. I. M. A. and the Stock were better prepared than the plot worked by oxen.

In the *Quinze Arpents* field on the other hand, the ground was wet, the work of the C. I. M. A. left room for criticism, while that of the Stock was quite unsatisfactory. It is not surprising therefore that the crops were heavier on the plot ploughed by oxen.

844 – **New Machine for Topping, Tailing and Rowing Turnips.** — I. – The *North British Agriculturist*, Vol. LXVII, No. 17, p. 274. Edinburgh, April 29, 1915. — II. – The *Implement and Machinery Review*, Vol. 41, No. 483, pp. 340-341. London, July 1, 1915.

For a long time past many attempts have been made to bring out a really efficient turnip topping and tailing machine, but none appear to have given complete satisfaction. Messrs. Smith and Wood of Montrose, Scotland, have recently built and experimented before a number of agriculturists a new machine which not only tops and tails the turnips but leaves them in rows on the field.

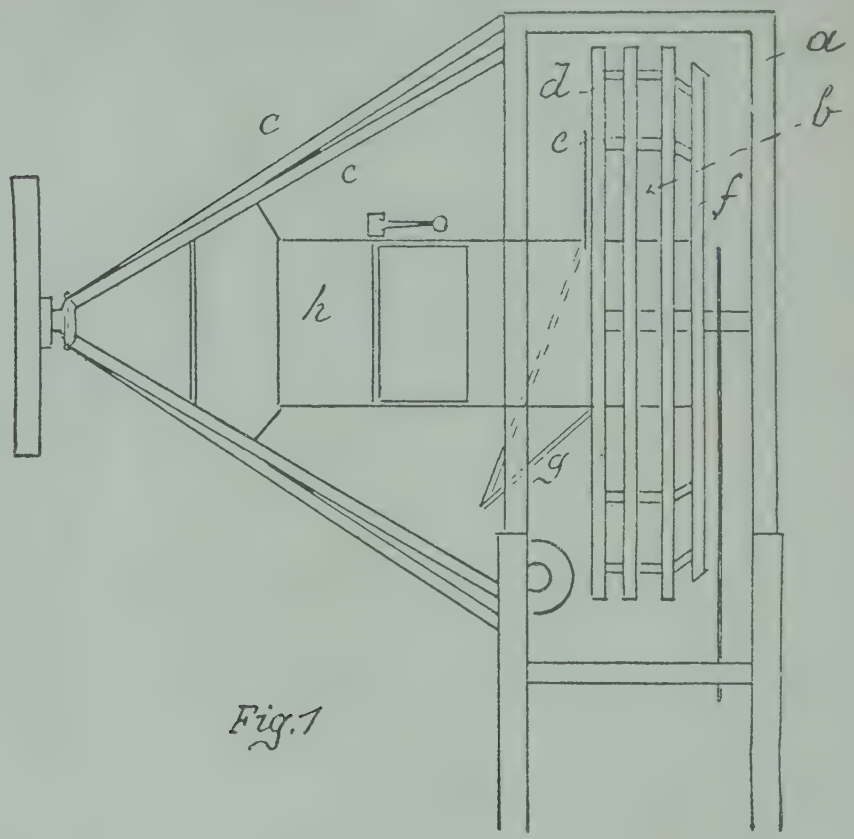


Fig. 1

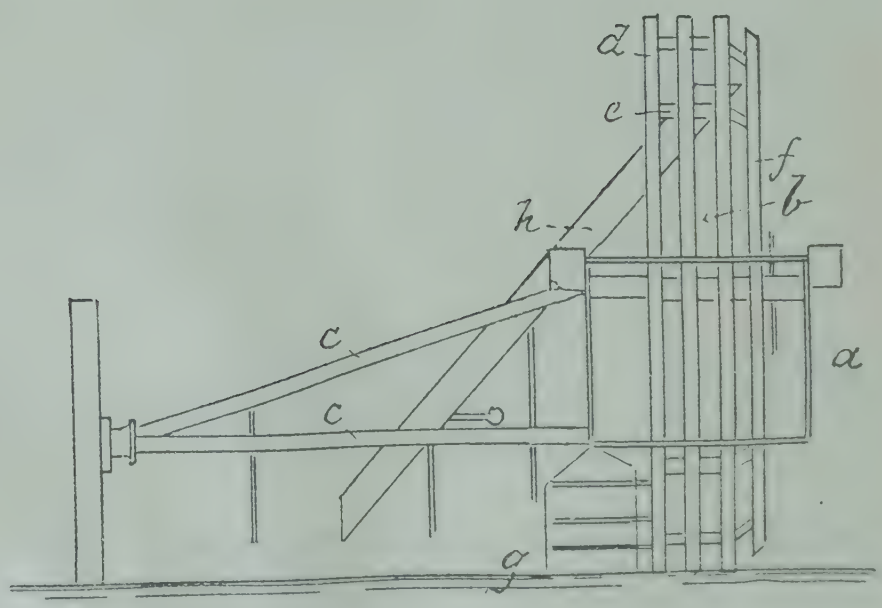


Fig. 2

SMITH and WOOD's machine
for topping, tailing and rowing turnips
Fig. 1, plan; Fig. 2, front view.

Most farmers still do this work by hand. It is a most fatiguing operation and as in England and Wales upwards of a million acres are every year under turnips and swedes it will be understood that a really good machine would be very welcome.

This machine is very simple in construction, as the accompanying figures show (fig. 1 plan, fig. 2 front view). An open box frame (*a*) with the shafts in front is supported by the wheel or drum (*b*), the central shaft of which is mounted on the frame. This is provided with an outrigger (*c*) with a small bearing-wheel fixed at 6 ft. 9 in. from centre of drum. This wheel or drum consists of a series of rings (*d*) bound together by radial spokes. (*e*). The outer ring is somewhat smaller than the others while the inner one is of full diameter and sinks to a certain extent into the ground at the side of the turnip. For removing the shaws a circular knife revolving at high speed is employed. It is supported on a frame which rises and falls so that it is adjusted to the various sizes of turnips. The saw revolves counter-clockwise and flings the shaws beneath the drum. For cutting the roots or tails, a blade or knife (*g*) is fixed at a suitable angle and suspended by an arm which can be moved vertically by a hand lever so that the depth of the blade may be readily adjusted. The blade travels beneath the ground, cuts the roots and leaves the turnips free. Behind this blade is a guide that presses the turnips into the drum which is provided with a series of pockets for their reception, which convey them to the top of the drum whence they fall into the shoot (*h*) which deposits them on the ground. The shoot is provided with a door which is actuated by a weighted lever and retained by it in the open or closed position. By the opportune opening or closing of this door the turnips from four drills are collected and deposited in one row.

In ordinary land one horse is sufficient to draw the machine and will raise 4 acres of turnips per day.

845 - **The "Downie" Nut-cracking Machine.** — *The Implement and Machinery Review*, Vol. 40, No. 478, pp 1257-1258. London, February 1, 1915.

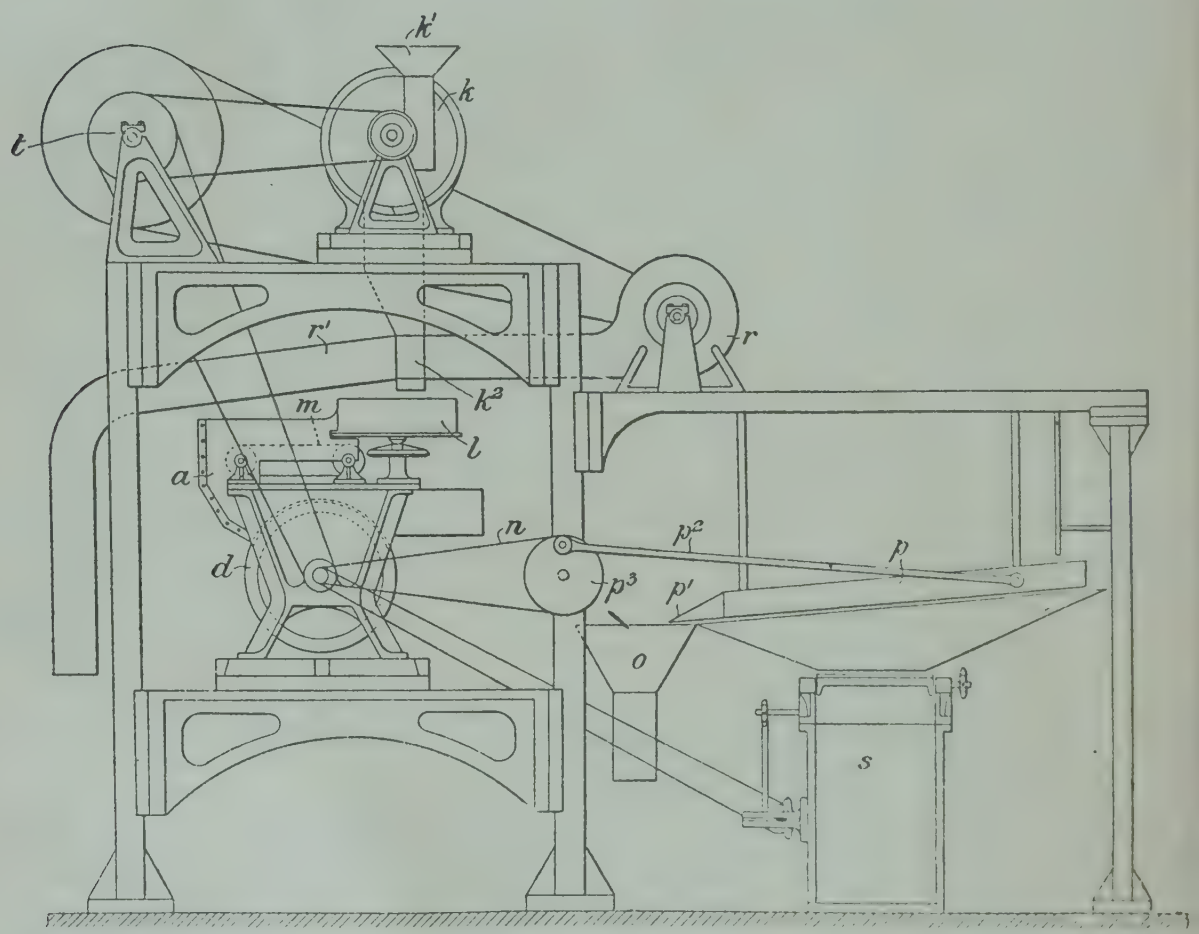
An enormous quantity of oil derived from palm and other nuts is used every year. In 1914 the United Kingdom alone imported 169 662 cwts. of palm kernel oil, valued at £340 102, whilst nuts and kernels for oil production were imported to the value of £3 584 193. Probably the most tedious task in connection with the nut oil manufacture is the breaking of the nuts. In many places it is done by hand by native women and children; in other localities hand power machines, which effect a saving of 40 per cent, are used. The question is still receiving much attention from inventors.

The advent of the comparatively new edible-oil nut, the cohune nut, from Central America has increased the demand for nut-cracking machines, one of the most recent of which is the "Downie". The main difficulty was to break the thick and very hard shell of the nut without injuring the kernel. The original intention of the inventor was to produce a hand machine, but after practical trials power was adopted and the "Downie" is driven by a 5 HP. oil engine. The extraction of kernel must be effected abroad, as it represents only about 13 per cent of the original nut.

The " Downie " includes a husker for removing the fibrous coat which envelops the nut, but it can also deal with the coated nuts. The accompanying figure shows the whole machine.

The nuts are fed to the husker k through a hopper k^1 and pass thence through a shoot k^2 to a revolving table l, which delivers them by means of a travelling belt m to the hopper a and thence into the revolving drum or wheel d.

This drum throws the nuts against an anvil or breaking block. The broken nuts fall from the anvil back on to the drum and are subsequently



discharged by the rotary movement of the latter to a travelling belt n which conveys them to an inclined riddle p of sufficient mesh to allow the kernels to pass through. The larger portions of shell pass into a shoot o, whilst the kernels and small portions of shell drop through p into a separating device s. A fan r provided with a pipe r^1 clears away the husks from the shoot k^2.

It is estimated that the machine is capable of cracking 36 000 nuts per hour, yielding 450 lbs. of kernels, but allowing for contingencies, the breaking of a ton of nuts may be considered an average day's work.

846 – Review of Patents.

Tillage machines and implements.

Canada
160 732. Plough mechanism.
160 803. Harrow.

Italy
145 827. Cultivator.
147 117. Implement that can be used as a pickaxe, hoe, spade or lever.

United Kingdom
4 247. Machine for trenching and ridging land.
4 763. Motor agricultural implements (harrows, ploughs, etc.).

United States
1 137 770. Reversible disk plough.
1 137 857. Section harrow.
1 137 881. Plough.
1 137 934 — 1 138 112 — 1 140 238. Harrows.
1 137 952. Pulverizer attachment for plough shares.
1 138 307. Plough attachment.
1 138 546. Attachment to sulky ploughs.
1 138 635 — 1 138 925 — 1 139 118. Cultivators.
1 138 996. Harrow and cultivator.
1 139 751. Gang plough.
1 139 840. Cultivator or plough attachment.
1 140 019. Adjustable frame cultivator.
1 140 144. Cotton chopper.
1 140 275. Ploughshare.

Manure Distributors.

United Kingdom
4 790. Sand or manure distributor.

United States
1 137 924 — 1 139 481 — 1 139 498. Manure spreaders.
1 140 266. Guano distributor and grain drill.

Drills and sowing machines.

United States
1 137 901. Seed planter.

Reapers, mowers and other harvesting machines.

Canada
160 393. Sheaf stooker.

United Kingdom
2 427. Hay-cocking machine.
3 700. Sugarcane harvester.

United States
1 138 304. Machine for harvesting and reducing corn or other growth to silage.
1 138 953. Kafir corn header.
1 138 987. Canvas butter for binders.
1 139 013. Double carrier attachment for binders.
1 139 179. Cutter apparatus for mowers, etc.
1 140 175. Mowing machine.
1 140 244. Corn harvester.

Machines for lifting root crops.

United Kingdom
3 872. Machine for lifting turnips.

United States
1 138 371. Potato picker.
1 140 202. Beet harvester.

Threshing and winnowing machines.

Canada	160 376. Grain cleaner.
	160 858. Grain separator and grader.
Italy	147 256. Mountain threshing machine with simple fan, ball bearings and separator.
Spain	59 923. Improvement in disk or tooth rollers for threshing grain.
United Kingdom	3 265 — 3 520. Threshing machines.
United States	1 138 779. Corn shelling machine.

Machines and implements for the preparation and storage of grain, fodder, etc.

Switzerland	69 725. Hay press.
United Kingdom	4 589. Heater and drying apparatus for grain.
	4 649. Apparatus for conditioning grain.
United States	1 138 869. Silo.
	1 139 046. Hay press.
	1 139 157. Hay stacker.

Dairying machines and implements.

Canada	160 447. Milk heater.
	160 857. Milking mechanism.
Switzerland	69 624. Device for lifting dairy boilers.
	69 757. Dust and dirt-free milk pail.
United Kingdom	3 042 — 4 755. Cow milkers.
	4 342. Milk churn lids.

Other agricultural machines and implements.

Canada	160 607. Animal trap.
	160 705. Grain grinding machine.
	160 773. Fruit basket.
Denmark	20 194. Manger for feeding animals at certain intervals of time by electric device connected with a clock.
Italy	147 029. Heckling machine for hemp or other textile fibres.
Spain	59 908. Process for the industrial utilisation of potato peel pulp.
	59 910. Process for the manufacture of potato pulp.
	59 911. Process for the manufacture of potato starch.
	59 928. Machine for washing olives and the like.
Switzerland	69 829. Apparatus for raising water by means of compressed air.
United Kingdom	2 260. Weed poisoning tool.
	2 468. Machine for depericarping palm fruit, olives, etc.
	2 598 — 4 337. Machine for cracking nuts.
	2 627. Latex coagulating apparatus.
	2 782. Device for releasing animals in case of fire.
	3 698. Apparatus for preparing fibres for spinning.
	3 888. Apparatus for preparing peat.
	4 495. Heckling machines.
	4 593. Agricultural tractor.
	4 621. Crates for flowers.
	4 723 — 4 724. Machines for pulping fruit.
United States	1 138 453 — 1 138 996 — 1 139 009. Tractors.
	1 138 940. Wire reeling and unreeling machine.
	1 140 221. Windmill.

847 - **The Engineering Properties of Soils.** — DAVIS, R. O. E. (Bureau of Soils, U. S. Department of Agriculture, Washington) in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 5, pp. 422-425, diagrams. Easton, Pa., May 1915.

BUILDING CONSTRUCTION

The engineering properties of the soil come next in importance to that of its productiveness, since on them depend directly or indirectly the construction and maintenance of the works of drainage, irrigation, etc. It is only in recent times that interest has been shown since little was thought to be known of these properties. The properties of the soil from the point of view of the engineer are those that are of importance from the physical point of view, that is to say the physical characteristics considered by soil analysts.

The factors determining the physical properties are mechanical composition, mineralogical composition and moisture. All these factors, particularly the last named, are variables. All the physical properties of a soil are modified according to changes in moisture, and each soil has a definite moisture content at which the properties attain either a maximum or a minimum: this is the critical moisture content of the soil.

If the soil is alternately moistened and dried several times it acquires a degree of compactness known as "natural packing", which varies according to the moisture in a manner analogous to the other physical properties.

The study of the engineering properties of the soil will consider the changes due to the specific conditions of the soil, but must also take into account its dynamic conditions.

RURAL ECONOMICS.

848 - **Methods adopted for Judging the Economic Results of Peasant Farming.** — LAUR, ERNST, in *Landwirtschaftliches Jahrbuch für Bayern*, Year 5, No. 2, pp. 95-113. Munich, 1915.

The writer first discusses the advantages and disadvantages of the different methods adopted for judging the economic results of peasant farms: 1) from the net returns; 2) from the income regarded from the points of view of private economy and national economy; 3) from the economies realised at the end of the financial year; 4) from the gross returns. The gross returns can very well be used as a criterion for judging the total result of the farm in default of knowledge of the net returns calculated according to an exact and scientific method. This is shown by Table I, which is based on the results of the books of the Swiss Peasants' Secretariate, in which the farms are arranged in groups according to the aims of their production, and the groups thus formed are entered according to the amount of their gross returns. It results that the return per unit of area and per cent of the working capital increases at the same time as the gross returns.

TABLE I. — *Parallelism between gross returns and net returns.*

Type of farm.	Averages of years 1904-1912		
	Gross returns per hectare	Net returns. per hectare	Net returns. per cent of working capital
	francs	francs	
Bullock-fattening	525	96	2.14
General cattle-fattening	580	119	2.55
Dairy.	709	211	3.89
Calf-fattening	801	215	4.06

The best answer as to the success of the organisation of a farm is given by keeping accounts by double entry. For this the estimation of the gross returns is of great importance, and it is often said that herein lies the great hindrance to the general introduction of this system of book-keeping. The writer is of opinion that it is impossible to prescribe any one system of estimation to be employed in all cases, but that the method of estimating the gross returns must always be adapted to the special case in question. In peasant farms where book-keeping by double entry will never be as widely practised as it deserves, on account of extrinsic rather than intrinsic difficulties, the problem can often be solved by the help of special calculations. Thus, for example, it is often desirable to know whether milk should be sold or fed to calves. If the special cost is the same in both cases, and the value of the manure obtained is equivalent to the cost of the straw used for litter the profitableness of using the milk for feeding calves in comparison with selling it, can be calculated by means of the following formula, allowing that 10 lbs. of milk produce 1 lb. of increase in weight :

$$\text{Utility value of milk} = \frac{(\text{increase in weight} \times \text{selling price}) + (\text{initial veight} \times \text{advance})}{10 \times \text{increase in weight.}}$$

In this formula the term " advance " refers to the difference in price per lb. of live-weight between a fat and a lean calf. We thus obtain, by the help of this formula, the price at which the milk must be sold in order to give the same net return as if it were used for fattening calves, given the sale price per lb. of live-weight as estimated.

In order to decide the question whether it is best to produce milk, or fatten bullocks, the following formula can be employed if it is allowed that the production of 1 lb. of live-weight requires a number of starch-values 10 times larger than that of 1 lb. of milk, and that the initial weight of the cattle is increased by one-quarter during fattening :

$$x = \frac{\text{Price of 1 lb. of live-weight} + (4 \times \text{advance per lb.})}{10} + 0.08$$

In this formula x represents the price of milk (expressed in pence per lb.) required to give the same net return as the price of the equivalent live-weight increase. The number 0.08 signifies that the special expenses of producing milk (due to the animals being fed on substances richer in protein, to the higher risk and to the depreciation of the cows) are greater by 0.08*d* per lb. of milk than the special expenses of fattening.

When it is a question of fattening young cattle, it can be calculated that the production of 1 lb. of increase in weight only requires 4.5 times the number of starch-values needed for producing 1 lb. of milk. Nevertheless, we must here take into account the increase of cost due to feeding very young cattle on a milk basis. Supposing that the price of all the forage consumed by the animal throughout its life has been increased (by giving it milk) by a sum representing $^3/_4$ of the price of 1 lb. of milk and that the production of 1 lb. increased weight requires an average of 2.5 lbs. of starch-values, the gross return, or the price of 1 lb. of live-weight of the fattened animal, must be reduced by $^3/_4$ of the price of 1 lb. of milk multiplied by 2.5. Thus we shall have the following formula :

$$x = \frac{\text{Price of 1 lb. of live-weight} - [(\text{price of milk} \times 0.75) \times 2.5]}{4.5} + 0.08$$

In the case of all these formulae, it should not to be forgotten that the best plan is to calculate directly, for each separate farm, the value of the relative numbers (10 and 4.5 in the above formulae) and the increase in the cost of fattening young cattle due to their food costing more.

Another way of fixing the relations between the organisation methods and the economic result of the farming consists in the comparative examination of a certain number of farms obtained by book-keeping by single entry; in this manner it is possible to solve the difficult question of the calculation of the cost of production. The writer refers to the " unitary method " devised by him for this purpose (1). He then gives some instances of similar researches relating to the influence of different measures of organisation upon the economic results of the farming.

If the Swiss peasant farms are divided, for instance, according to the different degree of subdivision of the land, the influence exerted on the net return by the more or less good arrangement of the estates can very well be recognised, as is shown by Table II.

The fact that the net return no longer increases in the last group is probably due to the circumstance that " very satisfactory " can only be awarded to a limited number of small farms, so that the average for the group is drawn from too few cases. The labour expenses show no regularity in their variation from one group to another, but the other working expenses increase regularly from the 1st to the 5th group; the intensity of cultivation is thus greater, the better the arrangement of the estate. The gross returns value increases in the same way; we may conclude that the

(1) See in this connection : *B.* July 1913, No. 854. (*Ed.*).

restriping of holdings is not only a very important measure for individual economy, but also greatly affects the interests of national economy. In Table III the farms are arranged according to the intensity of cultivation.

TABLE II. — *Influence of arrangement of estates upon net returns.*

Conditions of estate as regards subdivision of the land.	Averages of years 1904-1912.					
	Expenses of labour per hectare	Other expenses per hectare	Total working expenses per hectare	Gross returns per hectare	Net returns	
					Per hectare	Per cent of working capital
	francs	francs	francs	francs	francs	
Very unsatisfactory .	465	151	616	651	35	0.43
Unsatisfactory	459	214	673	741	68	1.01
Average	472	251	723	894	171	2.39
Satisfactory	428	296	724	965	241	3.68
Very satisfactory . .	447	420	867	1086	219	3.33

TABLE III. — *Arrangement of farms according to intensity of cultivation.*

Intensity of cultivation of farms	Average of years 1904-1912.			
	Gross returns		Net returns	
	Per hectare	Per cent of working expenses	Per hectare	Per cent of working capital
	francs		francs	
Very slight	369	112	38	1.13
Slight	530	131	126	3.03
Average	696	138	190	3.66
Great	862	143	259	4.42
Very great	1099	151	370	5.63

Not only the absolute gross returns but also the net returns per unit of area and per cent of working capital, and even the gross returns per cent of working expenses increase regularly with the intensity of cultivation. This result is directly opposed to the theory of the law of diminishing returns from the soil. This is due, in the first place, to the fact that agricultural technique, which this theory regards as constant, undergoes changes and makes progress. Then a certain number of the farms have not yet attained the critical point at which the increased intensity of cultivation results in relatively smaller gross returns. Finally, the law of diminishing returns from the soil cannot be extended to all the working

expenses without distinction, for, especially in peasant farms, a whole series of expenses, such as the cost of administration, in many cases the cultivation and sowing expenses and, within certain limits, also the harvest expenses, are exactly the same in the case of a high or low gross return.

The writer also shows the influence of the difference of production of the farms upon their economic returns by dividing the Swiss farms into three groups according as they produce milk or meat, and calculating the average gross and net returns (Table IV).

TABLE IV. — *Gross and net returns in three groups of farms.*

	Dairy farms	Bullock-fattening farms.	General cattle-fattening farms.
Gross returns per hectare	709 francs	525 francs	580 francs
Net returns per hectare	211 francs	96 francs	119 francs
Net returns per cent of working capital .	3.89	2.14	2.55

This result depends essentially upon the prices of milk and meat, and follows their variations.

At the end of his article, the writer also briefly discusses the valuing of estates on the occasion of taking possession, which has a considerable influence on the economic result of the farms. He advocates the system of valuation based upon the returns ("Ertragswert") and mentions in this connection his method of estimation by means of the factors of this value (1).

849 - **Intensity of Cultivation and Net Yield in Farming.** (A Study of the development, special features and economic results of the principal systems of farming obtaining in Mecklenburg, Germany). — BAUMANN, E., in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 3-4, pp. 604-670, 7 plates. Jena, 1915.

The writer presents data on the working conditions of 17 farms of over 250 acres in Mecklenburg, collected by circular and referring to five farming years; on the results of these he discusses the connection existing between intensive cultivation and net returns.

As an indicator of intensity of cultivation, he takes the rotation followed and thus distinguishes four different degrees of intensity corresponding to four different rotations practised in the Meklenburg system of farming, which may be called the "Mixed Pastoral System" (« Koppelwirtschaft »). These four degrees of intensity are distinguished chiefly by the presence or absence of pastures or fallows, and by the greater or less proportion of arable land under root crops. The writer then shows how the increased intensity of cultivation of these farms is connected, generally at least, with

(1) See in this connection : *B.* Sept. 1912, No. 1337. (*E* .).

the more or less satisfactory conditions of soil and climate of the different groups. In the same way, the amount of capital represented by these groups of farms varies according to the degree of intensity. The capital in buildings and in live stock especially shows an increase with increasing intensity of cultivation, while there is only a very slight connection between the latter and the amount of the dead stock.

The increase in the degree of intensity is also shown by the receipts and expenditure, as well as by the net returns. While under the most extensive system with pastures and fallows the sales from arable crops and live stock are about equal, in the more intensive systems the receipts from cattle are much less than those from the crops. On the other hand, the relative proportions of the different expenses (cost of seeds, fertilisers, concentrated foods, labour, upkeep of buildings, improvements) vary little with increased intensity of cultivation.; they do, however, increase to a considerable degree as far as the absolute amount is concerned. The net returns, which in all these farming systems are about one-third of the gross returns, show a large and gradual increase as we pass from extensive to intensive systems.

Naturally there are exceptions to the rules established by these researches, exceptions due to special conditions, and whose causes can be determined by the assistance of these comparisons. The influence of a system of farming upon the intensity of cultivation and the net returns is such, that by its side all other factors regarded as important from their effect upon the economic results become insignificant. Such factors are: soil conditions, relation between the area of pastures and of arable land, and individuality of the farmer, all of which have already made their influence felt upon the choice of the farming system.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

850 – **Utilisation of Alcohol in Russia.** — *Journal d'Agriculture Pratique*, Year 79, No. 48, p. 428. Paris, June 3, 1915.

The consumption of alcoholic beverages being now forbidden in Russia, the distilling industry which is a very important one in that Empire, would be seriously injured unless some new means of utilising alcohol were found.

With the object of stimulating research in this direction the Russian Ministry of Finance has organised two international competitions, one for new uses to which alcohol can be put and the other for its denaturation.

The prizes offered are handsome, the principal conditions under which they are to be competed for are as follows:

Utilisation of alcohol. — Three prizes of £4230, 3172 and 1057 are offered to the inventors of new processes for the transformation of alcohol into other quite different products, such as vinegar, chloroform, ether, etc.

Three prizes of £5286, 2114 and 528 for new processes for the manufacture of products into the composition of which alcohol or its derivates

enter, but in such a manner that it cannot be again extracted from them. Pharmaceutical perfumery products are types of this class.

Three prizes of £3172, 1586, ad 528 for new processes in which alcohol or its derivates are used as auxiliaries, as for instance in the manufacture of smokeless powder and artificial silk.

Four prizes of £7930, 5286, 3172 and 2114 for inventions, and improvements of existing inventions, for the use of alcohol for internal combustion motors.

Four prizes of £7930, 5286, 3172 and 2114 for inventions, and improvements of existing inventions, concerning the use of alcohol as fuel.

Four prizes of £5286, 3172, 1586 and 528 for the use of alcohol for lighting purposes.

Denaturation of alcohol. — Three prizes of £3172, 1586 and 528 for the discovery of new substances, or improvement of existing compounds, for denaturing alcohol, which, while allowing the free circulation of denatured alcohol, render its use as a beverage impossible.

The competing memoirs must be presented before January 1/14, 1916. They must be written in Russian and French and addressed to the "Direction générale des contributions indirectes et de la vente de l'alcohol" (W. O. Quai Toutchkoff 2, Petrograd) in a sealed envelope bearing a motto but not the inventor's name, which must be enclosed in a separate envelope bearing the same motto.

The prizes will be awarded not later than July 1/14, 1916. The prize winners will retain the ownership of their inventions which they are allowed to protect by patents and to work if they like.

851 – **Contribution to the Study of the Ferments of Rum.** — KAYSER, E., in *Comptes-rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 13, (March 29, 1915) pp. 408-411. Paris, 1915.

The composition of the alcohols resulting from the fermentation of sugarcane juice depends chiefly upon the micro-organisms giving rise to the fermentation of the saccharine substances. In fact, if to sterile molasses must are added either rum yeast or the same yeast associated with a microbe isolated from the same molasses, in the second case we find a doubling of the non-alcoholic coefficient (increase in volatile acids, ethers, decrease in aldehydes and higher alcohols). If, on the other hand, there is added to a slow yeast (race II) rapid yeast of frequent occurrence in cane molasses (race XIV), a great increase in the non-alcoholic coefficient, and notably in the ethers, is also produced. The careful use of pure yeasts therefore would allow the rum maker not only to obtain constant products, and decrease the length of the fermentation from 3 or 4 days to 30 or 36 hours, but also to get a product more or less rich in ether according to the demand.

852 – **Composition of Maize Meal Manufactured by Different Processes and the Influence of Composition on the Keeping Qualities.**— WINTON, A. L., BURNET, W. C., and BORNMANN, J. H. — *U. S. Department of Agriculture, Bulletin* No. 215, 31 pp. Washington, May 21, 1915.

Although the consumption of maize meal is greatest in the South of the United States, the production of maize is greatest in the States of the Middle West forming the " corn belt ".

The corn and grits used in the South are prepared almost exclusively from white dent maize. In the North the preference is usually given to meal made from yellow maize, though white maize hominy is also common.

With few exceptions the southern mills grind the maize by stones which grind the whole kernel without previously removing the germ ; sometimes the meal is bolted. In most of the mills no attempt is made to dry the maize or the meal. In the northern mills rolls have largely replaced stones. Preliminary to grinding, the grain is put through the " degerminator ", which loosens the germ, from which corn oil is manufactured, leaving a cake, used to feed live stock. Maize is tempered by steam or water preliminary to the milling process. After milling, the products and by-products are dried either before or after separation.

The products and by-products of the roller process are: 1. corn flour, the finely divided material separated by bolting; 2. corn meal separated into two or more coarser or finer grades, and designated also as table or brewer's meal; 3. grits, used either by the brewer or for the table; 4. the germ, which is pressed for the manufacture of corn oil, the residual cake being used as cattle food; 5. corn bran, and 6. corn feed, consisting usually of a mixture of bran and the finely divided offal, to which often ground corn cake is added.

The writers analysed the products of 41 mills located in 17 States, at the Chicago Food and Drug Inspection Laboratory, according to the methods of the Association of Official Agricultural Chemists, with the exception of the acidity which was determined by SCHINDLER'S method. The average results are given in the table opposite.

As this table shows, the products of a white maize mill may be arranged in the following order in regard to acidity, fat, fibre, and ash, beginning with the lowest percentage : grits, meal, flower, feed and germ. They may be arranged in the following order in regard to protein : flour, meal, grits, feed, and germ. The percentage of nitrogen-free extract is not strikingly different in the grits and meal, but is lower in the feed and lowest in the germ.

Whole-kernel meal at the time of grinding is the same in composition as the grain except in regard to moisture, but soon develops a greater acidity. The higher the degree of acidity, the less is a meal suitable for food; hence whole-kernel meal should be produced locally and consumed without delay. Bolted, undegerminated meal contains less fibre than the grain. Degerminated, bolted meal contains less protein, fat, fibre and ash, but more nitrogen-free extract, than the grain.

Low-grade (Standard) meal contains sometimes more and sometimes less of each constituent than the grain.

Composition of the products and by-products of maize milling.

	Moisture	Acidity (*)	Protein	Fat	N-free extract	Crude fibre	Ash
	Per cent		Per cent	Per cent	Per cent	Per cent	Per cent
White maize:							
Grain	13.52	27.5	9.12	3.62	70.50	2.02	1.22
Grits, coarse	13.07	16.4	8.78	0.48	76.78	0.53	0.36
» fine	12.12	16.6	8.66	0.64	77.68	0.48	0.42
Meal, cream	11.97	19.1	7.85	1.41	77.65	0.56	0.56
» brewers'	11.95	18.1	8.00	1.23	77.59	0.64	0.59
Flour	11.19	22.1	6.78	2.87	77.61	0.80	0.75
Germ	6.64	59.3	16.62	23.79	40.30	6.04	6.61
Germ cake	2.14	68.6	20.22	7.26	54.39	7.90	8.09
Feed (including bran)	11.00	52.4	11.69	8.44	60.99	5.03	2.85
Bran	10.13	49.2	8.43	6.71	62.85	9.72	2.16
Yellow maize:							
Grain	13.45	35.4	9.16	5.10	68.89	2.06	1.34
Meal, bolted, coarse	12.88	18.0	9.78	0.90	75.60	0.45	0.39
» » fine	13.10	21.1	9.09	2.19	74.48	0.53	0.61
Germ	11.29	62.5	13.34	18.07	79.25	3.98	4.07
Bran	10.37	66.5	9.06	11.00	57.19	9.68	2.70
White maize and meal, unbolted:							
Whole-kernel, stone ground meal and grain from which meal was milled, average	12.18	29.0	8.35	4.01	72.19	1.97	1.30
Bolted, undegerminated meal and grain from which meal was milled, average	12.99	30.5	8.75	3.90	71.19	1.30	1.27
Degerminated, bolted roller ground meal and grain from which meal was milled, average	13.98	17.0	6.95	1.43	76.42	0.70	0.52
Low grade "standard" (**) table meal and grain from which meal was milled, average	12.41	25.2	8.67	3.89	72.48	1.27	1.28
Yellow maize meal:							
Degerminated, bolted, roller-ground meal and grain from which meal was milled, average	14.95	17.0	7.52	0.99	75.48	0.63	0.43

(*) Expressed in the number of cc. of normal alkali required to neutralise the acidity in the extract from 1000 grams of the meal.

(**) This is a by-product of mills producing a higher grade of meal or grits or both.

The writers carried out also a series of tests on the chemical modifications to which the different types of products are subject during storage in 100 lb. storage sacks in various localities. The results are shown in several tables and may be summarised as follows:

Ton lots of degerminated bolted meal, with a range in moisture content, were stored at Savannah and Chicago. The lot containing 16.86 per cent of moisture showed an excess of acidity in 12 weeks, a loss of fat in 16 weeks, and a musty taste in 20 weeks. The lot containing 15.04 per cent of moisture only slightly exceeded the limit for acidity (30) in 24 weeks, and did not suffer in taste or appearance, while those with 13.41 or less kept well in all respects up to the end of the experiment (24 weeks).

Carload lots of degerminated, bolted meal, with 15.73 per cent of moisture, showed an excess of acidity at Savannah in 8 weeks and at Chicago in 12 weeks, but did not suffer appreciably in quality. Highly dried meal with 9.86 per cent of moisture after 24 weeks showed a maximum acidity of only 21.8.

Comparative experiments with whole-kernel and degerminated, bolted meal, undried and dried to different degrees, and stored at Savannah and New Orleans, showed the superior qualities of the latter. Even when dried to 10.79 per cent of moisture the whole-kernel meal developed excessive acidity in 8 weeks and became rancid in 20 weeks, while with 15.71 per cent of moisture or higher, in addition to becoming acid, it sooner or later heated and caked. The loss in weight accompanying heating exceeded the loss of moisture.

Degerminated, bolted meal containing 13.78 per cent or less of moisture kept in all respects for 28 weeks, and that containing 15.72 per cent, although it became stale in 20 weeks, did not develop excessive acidity. The undried meal containing 19.20 per cent of moisture, although it heated within 4 weeks, unlike the whole-kernel meal did not increase markedly in acidity. Meal of the two kinds milled in April 1914 without drying and containing about 18.5 per cent of moisture, spoiled within two weeks at New Orleans. Only the whole-kernel meal developed an excess of acidity.

A study of all the results leads to the conclusion that degerminated bolted meal containing not over 14 per cent of moisture and 1 per cent of fat, properly stored should keep for six months. SCHINDLER'S limit for moisture, namely 13½ per cent, obtained by drying in an open dish, corresponds to about 14½ per cent by the method of the Association of Official Agricultural Chemists (drying for five hours at the temperature of boiling water in a current of dry hydrogen, in WINTON'S apparatus).

Whole-kernel meal should be produced locally and consumed soon after grinding; properly dried, degerminated meal, keeps well during transportation and long storage.

853 - **Disadvantages resulting from the Addition of a certain Quantity of Rice Flour to the Wheat Flour used in Bread-making** (1). — LINDET, ARPIN and DUMÉE in *Comptes-Rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 10, pp. 300-302. Paris, 1915.

In order to give an accurate reply to the question raised by the French Minister of Agriculture as to what disadvantages would result from the partial substitution of rice for wheat in the manufacture of bread, the authors have made comparative tests of different types of loaf. Of these one was kept as a check while three others contained rice-flour in the proportions of 5, 10 and 15 per cent respectively. The conclusions reached were as follows :

1) The presence of rice flour gives a grey hue to the dough.

2) The crust loses its golden colour.

3) The greater the quantity of rice the less satisfactorily does the dough rise.

4) The taste is more insipid.

Further, the addition of rice flour means a modification in the work of the baker, as the dough rises less and loses its plasticity. In order to avoid the drawbacks of a badly risen dough it is best to add the rice flour when the dough is first " cut back " and " dusted ", that is to say when the baker, after having made a comparatively slack dough, adds a fresh quantity of flour. It is further advisable to draw the *levain* (leaven) (2) from simply kneaded dough before the rice-flour has been added.

Is is thus for the baker to make the mixture and not the miller.

Taking a superior quality of wheat flour quoted at 41*s* 8*d* per bag (of 280 lbs.) and a rice flour at 29*s* 1*d*, the mixture will be worth 41*s*, 40*s* 5*d* or 39*s* 9*d* according to whether the proportion of rice-flour is 5, 10 or 15 per cent. Of this flour 100 lbs. will yield 130 lbs. of bread ; the actual economy effected will thus be only between 2 and 6 hundredths of a penny per lb. This saving will not affect the ordinary consumer; it will only be felt in cases where the consumption is considerable, *e. g.* public bodies, State services, etc.

854 - **The Utilisation of Waste Oranges**. — CRUESS, W. V., in *California Agricultural Experiment Station, Bulletin* No. 244, pp. 157-170. Berkeley, Cal., 1914.

In California from 5 to 20 per cent of the orange crop is rejected owing to slight defects in shape, colour or size, or slight injury to the skin. These waste fruits are used in the manufacture of marmalade, candied peel, bottled pulps and syrups, various liquids and beverages and chemical preparations, such as extracts, oils and citrates. Examination of these products showed that those prepared by chemical or mechanical means were generally of good quality, whilst those involving some fermentation process were generally bad.

(1) See also *B.* May 1915, No. 545. (*Ed.*).

(2) *Levain* is the term applied to the substance used by French bakers in the manufacture of leavened bread ; it consists of a portion of the old dough held over from the previous baking. This lump of old dough, placed aside in a uniform temperature for some eight hours, swells and acquires an alcoholic odour. *Encycl. Brit.* (*Ed.*).

The preparation of orange juice, orange wine and orange vinegar were investigated in the Zymological Laboratory of the University of California.

Orange juice : It is recommended that the freshly expressed juice be allowed to defecate until it becomes fairly clear. To prevent fermentation during this period and to check the development of a bitter flavour, a moderate amount of sulphurous acid in the form of potassium metabisulphite should be added to the juice, immediately after crushing. The defecated juice should be filtered, bottled immediately and pasteurised, or pasteurised in barrels and kept until it is desired to bottle it. Sterilisation should take place at 180° to 185° F., at which temperature the flavour is not appreciably affected.

Orange vinegar : The fresh juice should be treated with 4 to 6 ounces of potassium metabisulphite per 100 gallons of juice (=0.025 per cent) and the juice allowed to stand for 24 hours or more, after which it is drawn off and fermented with pure yeast. Immediately after fermentation it is drawn off from the yeast and stored in well-filled closed barrels or tanks until it is convenient to turn the juice into vinegar. One-fourth of its volume of strong vinegar is then added to prevent the growth of wine flowers and promote vinegar fermentation, which should take place in containers allowing a good exposure to the air.

Orange wine : The fresh juice is defecated with potassium metabisulphite to prevent fermentation for a short time. The clear juice is then fermented with pure yeast and filtered. The wine may be kept in well-filled bottles without pasteurisation.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

855 – **The Freezing Point of Milk Considered in its Relation to the Detection of Added Water.** — MONIER-WILLIAMS, G. W. — *Reports to the Local Government Board on Public Health and Medical Subjects*, No. 103 (New Series), 32 pp. London, 1914.

As the freezing-point of milk varies only within very narrow limits and the addition of water has the effect of raising the freezing-point in proportion to the amount of water added, it has been suggested that these facts might form the basis of a useful test for the detection of milk adulteration. The statements published by various investigators as to the actual limits of natural variation in the case of pure milk are somewhat divergent. Owing to the apparent omission in the majority of cases of certain precautions which are essential to an accurate determination of the freezing-point, it is difficult to say how far these divergent results are due to natural causes or to errors of experiment.

A series of new and more accurate determinations was therefore carried out. In 141 samples of genuine milk, the freezing-point was found to vary between —0.558°C. and —0.514°C., with a mean of —0.5345°C. The values were subjected to all the necessary corrections and are probably accurate to about +0.002°C. The freezing-point appeared to be the most constant of any of the properties exhibited by genuine milk. Although unaffected by the removal of fat from, or the addition of separated milk to, genuine milk, it was raised by the addition of water to the milk.

Under certain circumstances the determination might be applied with advantage, as a confirmatory test, to the detection of added water and to

the approximate estimation of the amount present. Owing, however, to the experimental difficulties involved in obtaining reliable results, it is somewhat doubtful whether the method is capable of general application for purposes of milk control.

856 – **Determination of the Quantity of Fat in Cream.** — LINDET, L., in *Comptes-Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 1, No. 11, pp. 340-346. Paris, 1915.

The writer observes that GERBER's method of determining the quantity of fat does not give good results with cream. If one wants to deal with a quantity of fat equal to that contained in 11 cc. of milk (as the GERBER process prescribes) only 1 cc. of cream must be taken. But the quantity of cream that remains adhering to the pipette is not a negligible quantity when compared with so small a volume. On the other hand the observation of density based on the sum: density of the fat + density of the milk considered as free from fat, cannot give reliable results, because cream contains always a greater or lesser quantity of air introduced by the separator. Likewise it is not possible to determine the fat content, with sufficient approximation, by using DUCLAUX' pipette, because the writer has observed that the viscosity of the two elements constituting milk is very nearly the same, and that a cream diluted with more or less milk, and the milk which has been used for diluting, always give, with the same pipette, the same number of drops.

Under these conditions, if a process be found capable of titrating the fat in one drop of cream, the influence of the adherence of the cream to the walls of the pipette can be neglected and the volume of one drop issued from a given pipette may be considered constant.

The process adopted by the writer consists in placing the drop of cream on a piece of paper which is then kept at a temperature of 105° C. (221° F.) for two hours at most. The area of the spot that is thus produced is then measured and compared with that of a determined quantity of fat placed under the same conditions for the same time. In order to establish the standard, ten small pieces of butter without water, each about 0.01 cc., are placed at a distance of about 2 inches from each other (so that the grease spots do not run together) on a sheet of foolscap. The paper is weighed before and after placing the butter upon it; thus the weight of the butter is known to within one-hundredth. The titration will, in consequence, be fairly accurate.

The sheets with the butter and those with the drops of cream are exposed for the same length of time to the same temperature. The results will be more exact if the grease spots are not allowed to exceed 3 or 4 centimetres (1.2 to 1.6 inches) in average diameter. The spots are sometimes round, but more often elliptical, in which case both diameters must be measured in order to get the area.

The calculations to be made are as follows: Supposing the ten small pieces of butter weigh 0.102 gm. and the total area of the spots be 96.75 square centimetres, 0.001 gm. of butter will cover an area of 0.948 sq. centimetre; supposing that the spot formed by the drop of cream has an area of 9.6 sq. centimetres, that is 10.1 times greater, then the drop of cream will

contain 0.0101 gm. of butter. But as the drop of cream had, for instance, a volume of 0.044 cc. (225 drops to every 10 cc.), the cream contains 22.9 per cent of fat.

The writer compared the results obtained by his method with those obtained by desiccation and by ether extraction, and found that they agree sufficiently.

LINDET's methods is not suitable for the determination of the fat in cheese and in milk, in the former on account of the casein present which retains a certain quantity of fat, and in the latter on account of the attendant technical difficulties.

PLANT DISEASES

GENERAL INFORMATION.

857 - **Decree concerning the Organisation of a Research Department for Plant Diseases, in France, to be known as the "Service des Epiphyties".** — *Journal officiel de la République française*, Year XLVII, No. 136, pp. 3198-3201. Paris, May 20, 1915.

Under date of May 11, 1915, the President of the French Republic decreed :

Art. 1. — There shall be instituted at the Ministry of Agriculture a Service for the Study of Plant Diseases, which shall take the name of "Service des Epiphyties", and which shall comprise: 1) Stations for the study of plant diseases; 2) the phytopathological inspection of agricultural produce (1); 3) the control of imported forage seeds.

Art. 2. — The inspection of silkworm egg establishments and the Sericultural Stations shall be attached to the "Service des Epiphyties".

Art. 3. — The Consultative Committee on Phytopathology, constituted by decree of February 19, 1912 (2), shall undertake the study of questions relative to insects, cryptogams and other parasites injurious to agriculture which may be submitted to it by the Ministry, in particular as regards the processes to be used and the measures to be taken for preventing and controlling infectious diseases of plants.

Arts. 4 to 12. — Various administrative dispositions concerning the staff. The staff of the Stations shall comprise inspectors (inspector-general and three inspectors), directors (10 directors, four sub-directors), assistants (to the number of four) and laboratory boys. The inspectors shall be chosen from among the directors of Stations. For the initial organisation of the Service, however, they may be recruited from among inspectors of viticulture, phylloxera delegates and technical agents attached to the central administration, but only during the year following the publication of the present decree. Inspectors of viticulture may also hold appointments

(1) See *B.* April 1915, No. 438. (*Ed.*).
(2) See *B.* June 1912, No. 965. (*Ed.*).

as inspectors in the "Service des Epiphyties". Directors, sub-directors and assistants may be nominated among the staff of scientific establishments belonging to Communes, Departments, or Administrations of the State, for employment equivalent to that with which they were occupied in the Stations of the Ministry of Agriculture.

Art. 13. — Within the limits of the stated requirements and dispositions of the budget and outside the permanent staff, the Minister may assure the working of the Service by the temporary collaboration of special agents who shall receive a salary to be fixed by Ministerial decision.

Art. 14. — With the approval of the Consultative Committee on Phytopathology, subventions may be accorded to scientific establishments carrying out researches analogous to those of the Stations of the Service and dependent on Communes, Departments or Administrations of the State.

Art. 15. — With the approval of the Consultative Committee on Phytopathology, grants may be made to scientists for scientific researches concerning plant diseases. Such grants will be awarded annually.

Each year a report of the work of the Stations, subsidised establishments and missions carried out will be published obligatorily under the care of the Direction of Sanitary and Scientific Services and the Repression of Frauds.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

858 – **Observations on a Disease of Red Clover** (1). — MALENOTTI, ETTORE, in *L'Agricoltura italiana*, Year XI (5th Series), Part 8-10, pp. 233-236, figs. 1-4. Pisa, April 30-May 31, 1915.

The writer gives an account of three different investigations in the garden of the Royal Station of Agricultural Entomology at Florence on the serious disease of red clover (*Trifolium pratense*) known as "incappucciamento".

Three-year-old clover plants apparently succumbing to the disease were obtained from Cusona (prov. of Siena) and transplanted into three experimental plots after being freed from Scolytids and other insect pests.

The compact made soil, resting on a stony subsoil, poor in plant food either naturally or from exhaustion due to a century of cultivation, was prepared by deep digging and manuring with a good dressing of stable manure and ashes; in February of the following year a dressing of ashes was given.

The plants took on fresh vigour and produced normal shoots without a trace of the clustered malformation; some stems measured 3 feet in length and were entirely green and robust in appearance.

As it is considered that extracts of plants diseased by bacteria check the growth of plants to which they are applied, the second plot was treated

(1) See *B.* Dec. 1914, No. 1181. (*Ed.*)

with a mixture obtained by crushing the roots of clover seriously attacked by the disease. Seeds from healthy plants sown in this plot germinated normally; when the young plants were about 4 inches high they were sprayed with the same mixture. They continued to grow normally and showed no character resembling those of "incappucciamento".

On the third plot seeds from diseased plants were sown. These also germinated normally and produced vigorous plants without any symptoms of the disease.

Microscopical examination of the cortical, fibro-vascular and medullary tissues of the plants of the three plots showed the absence of bacteria.

"Incappucciamento" is therefore apparently not of bacterial origin. These experiments confirm the work of DEL GUERCIO, who maintains that the origin of the disease should be attributed to the combined action of several concomitant causes, such as prolonged drought, insufficient tillage and organic manures on the one hand, and of animal pests (*Apion*, *Hylastinus* and *Tylenchus*) on the other. This theory is in agreement with observations at Meleto in 1914 and 1915, where clover crops recovered their vigorous growth without any special treatment as a result of abundant rain and diminution of insects.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

359 – **Brazilian Fungi: New or Little-known Species.** — MAUBLANC, ANDRÉ, and RANGEL, EUGENIO, in *Secretaria de Agricultura, Commercio e Obras publicas do Estado de São Paulo, Boletim de Agricultura*, Series 16, No. 4, pp. 310-328, plates IV-IX. São Paulo, 1915. GENERALITIES

Among Brazilian fungi mentioned in this article occur:

Puccinia rugosa Speg. (= *P. rotundata* Diet.), observed on leaves, petioles and twigs of *Vernonia* sp., at Icahary near Niteroy, in October 1913: the fact that it produces deformity of the parts attacked was not previously recorded.

P. oxypetali P. Henn., on leaves and twigs of *Oxypetalum banksii*, at Praia de Ipanema, Rio de Janeiro, in March 1913: the twigs attacked are deformed, short and thickened, generally thicker than the branches from which they arise; indeed they form true "witches' brooms". The fruit-bodies of the fungus appear on the lower sides of the leaves, on parts of the shoots and on the flower-buds.

Didymopsora solani-argentei (Henn.) Diet., frequent on leaves of *Solanum argenteum* near Corcovado in July 1913.

Uredo aneimiae Henn., on living leaves of *Aneimia* sp., at Rio de Janeiro, Oct. 1913.

Prosporium rhynchosporae Henn., very frequent in flowers of *Rhynchospora glauca* near Corcovado, July 1913.

Uestadia multipunctata (Went.) Maubl. nom. nov. (syn. *Physalospora multipunctata* Went.), on various Melastomataceae near Rio de Janeiro, 1913.

L. medinillae Rangel (new), on living leaves of *Medinilla magnifica* at Ic rahy, Nov. 1913.

Sphaerella ilicicola Maubl. (new), on leaves of maté (*Ilex paraguariensis* with *Cercospora ilicicola* (also new), at Paraná, July 1912.

Chaetolentomita lignorum Maubl. (new genus and species), on decayed wo at Rio de Janeiro, Dec. 1912.

Leptosphaeria paraguariensis Maubl. (new), on leaf-spots due to *Cercospo ilicicola* on maté at Paraná, July 1912.

Pocosphaeria anonae Rangel (new), on living leaves of *Anona reticulata* Mimoso, State of Espirito-Santo, Nov. 1910.

Ophiobolus anonae Rangel (new), as last.

Gibberella saubinetii (Mont.) Sacc., on ears of wheat from the State of Paran with *Fusarium rostratum* Appel et Woll., Jan. 1913.

Calonectria coralloides Maubl. (new), on *Meliola* sp. on leaves of Melast mataceae, associated with *Trichothyrium fimbriatum* Speg., at Rio Janeiro, Dec. 1912.

Phyllosticta lageniformis Rangel (new), on living leaves of *Medinilla magn fica* at Rio de Janeiro, Sept. 1913.

P. ixorae Rangel (new), on living leaves of *Ixora coccinea* at Rio de Janeir Oct. 1910.

P. bauhinicola Rangel (new), on living leaves of *Bauhinia*, with *Clad sporium* sp., at Niteroy, March 1913.

P. granati Rangel (new), on living leaves of pomegranate (*Punica granatu* in the States of Rio de Janeiro and Minas Geraes, Dec. 1910.

P. medinillae Rangel (new). on living leaves of *Medinilla magnifica*, wi *Laestadia medinillae*, Icarahy, Nov. 1913.

P. begoniae Rangel (new), on living leaves of a cultivated *Begonia* at Niter Aug. 1910.

P. marantaceae Rangel (new), on living leaves of a cultivated Marantaceo plant at Niteroy, Oct. 1910.

Ascochyta cannae Rangel (new), on living leaves of a cultivated *Canna* Pinheiros, State of Rio de Janeiro, July 1913.

A. (*Ascochytella*) *marantaceae* Rangel (new), on living leaves of a cultivat Marantaceous plant at Niteroy, Oct. 1910.

Stagonospora ixorae Rangel (new), on living leaves of *Ixora coccinea* Rio de Janeiro, Nov. 1910.

Gloeosporium marantaceae Rangel (new), on living leaves of a cultivat Marantaceous plant at Niteroy, Dec. 1910.

Colletotrichum medinillae Rangel (new), on living leaves of *Medini magnifica* at Icarahy, Sept. 1910.

C. dichorisandrae Rangel (new), on living leaves of *Dichorisandra thyr flora* at Paquetá, near Rio de Janeiro, Dec. 1910.

C. bignoniae-igneae Rangel (new), on living leaves of *Bignonia igne* Icarahy, July 1912.

C. hibiscicolum Rangel (new), on living leaves of *Hibiscus tiliaceus* at P heiros, July 1913.

Pestalozzia paraguariensis Maubl. (new), on leaf-spots due to *Phyllosticta yerbae* Speg. on maté at Paraná, July 1912.

P. ixorae Rangel (new), on living leaves of a cultivated *Ixora* at Rio de Janeiro, Aug. 1910.

P. medinillae Rangel (new), on leaf-spots due to *Laestadia medinillae, ut sup.*

Cercospora ilicicola Maubl. (new), on living leaves of maté (*Ilex paraguariensis*) at Paraná, July 1912.

C. trigonellae Maubl. (new), on living leaves of fenugreek (*Trigonella foenum-graecum*) at Pinheiros, July 1913.

C. paulensis Henn., on leaves of *Cassia* sp. at Penha, near Rio de Janeiro, and at Icarahy, June-Aug. and Nov. 1912 and 1913.

C. cydoniae Rangel (new), on living leaves of quince (*Cydonia vulgaris*), Dec. 1910.

C. grandissima Rangel (new), on living leaves of *Dahlia variabilis* at Paquetá, Feb. 1913.

C. psidii Rangel (new), on living leaves of *Psidium araça* near Niteroy, May 1913.

C. scabiosicola Rangel (new), on living leaves of *Scabiosa atropurpurea* at Paquetá, Sept. 1913.

Leandria momordicae Rangel (new genus and species), on living leaves of *Momordia charantia* at Icarahy, June 1913 : it is a serious pest.

Ciliciopodium aurifilum Gérard, on a decayed *Polyporus* at Rio de Janeiro, June 1913.

Didymothozetia mimosoensis Rangel (new genus and species), on round dead spots on leaves of *Piper nigrum* at Mimoso, Nov. 1913.

DISEASES OF VARIOUS CROPS

860 – **Action of Sulphuric Acid on Wheat Straw-Blight (*Leptosphaeria herpotrichoides*)** (1). — CAPUS, J., in *Comptes-rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 6 (May 12, 1915), pp. 224-231. Paris, May 1915.

The writer gives the results of researches and experiments made in the Gironde in 1914 on the use of sulphuric acid as a means of checking straw-blight of wheat, caused by *Leptosphaeria herpotrichoides* De Not.

In examining the effects of the acid on wheat, the writer has shown that the blades of the outer leaves are the parts most affected by the treatment.

Sulphuric acid does not act directly like an antiseptic, such as copper sulphate, but indirectly, causing first the death of the green portion of the leaf and the upper part of the sheath, followed by etiolation of the remainder of the sheath.

It is interesting to note that mechanical actions such as mowing or the grazing of sheep, which, like the acid, destroy the leaf-tips, are also considered to be effective against the disease. In most cases the withering of the external sheaths coincides with a stoppage of growth and a diminution of vigour. Now it is known that wheats of slow growth are generally less attacked by the disease than more vigorous varieties. It is not the

(1) See also *B.* March 1914, No. 291. (*Ed.*).

reduction in vigour which interferes with the development of the disease, but rather the reduction in moisture-content of the external sheath which accompanies it. In very damp soils, the outer leaves do not wither rapidly: the plant is at first saturated with moisture — a condition favourable to the straw-blight — the leaves become chlorotic and only later wither up. Stagnant moisture first favours the disease before causing death of the leaves.

If the action of sulphuric acid can be explained by these facts, it is easy to understand why it does not act under all circumstances, and that there is a specially favourable period for its application. The treatment sholud be effective whilst the disease is in the incubation stage in the first sheath or when the first symptoms appear. It is also necessary to consider that straw-blight does not appear in all fields at the same time nor in all the stems of the same field. The earliest sown wheat suffers the first attack of the disease.

The sulphuric-acid treatment will therefore be effective for a crop in which the disease is in the incubation stage, but it may be of no value in other cases in which it has already broken out on the first sheaths.

861 – **Fungi Parasitic on Pigeon Peas *(Cajanus indicus)* in Brazil.** — RANGEL, EUGENIO, in *Secretaria de Agricultura, Commercio e Obras publicas do Estado de São Paulo, Boletim de Agricultura*, Series 16, No. 2, pp. 145-156, plates I-III. São Paulo, 1915.

In October 1910 and March 1911 the writer observed in the States of Rio de Janeiro, São Paulo and Minas Geraes, a disease of pigeon peas (*Cajanus indicus* Spreng.) characterised by the appearance of numerous leaf-spots from 2 to 3 mm. in diameter, scattered or in groups, rounded or irregular in shape, of a more or less chestnut colour and surrounded by a narrow dark brown border.

On the lower surface of the leaves were the felt-like fruit-bodies of a Hyphomycete, apparently the cause of the disease. This fungus, provisionally placed in the Stilbaceae, represents a new genus which the writer describes as *Vellosiella*; he describes the type species as *V. cajani* (Henn.) Rangel, synonymous with *Cercospora cajani* Henn., described in 1902 on leaves of pigeon peas from São Paulo.

The mycelium does not extend far beyond the point of infection but repeated attacks or an epidemic may seriously reduce the yield of the plant. In the case of a slight attack it is sufficient to remove and burn the infected leaves, but should the infection spread it is advisable to spray with a 1-2 per cent copper solution after removing the infected leaves.

In 1911 the writer also observed on both sides of the leaves of pigeon peas at Niteroy small angular spots, irregularly scattered or more often touching each other, and of a dark brown colour surrounded by a narrow prominent dark red band. These spots were caused by a new species of *Cercospora* (*C. instabilis* Rangel), which also, though more rarely, attacks the young or dried shoots and ripe and dried fruits.

The writer also gives Latin diagnoses of three other new Micromycetes also parasitic on *C. indicus*, *viz*: *Colletotrichum cajani* Rangel, found

on the leaves at Niteroy in May 1913; *Phyllosticta cajani* Rangel, also on leaves in the same locality in July 1911; and *Phoma cajani* Rangel, on dry fruits at Rio de Janeiro in August 1913.

562 - **Potato Blight (*Phytophthora infestans*) on Potatoes and Tomatoes in India.** — DASTUR, JEHANGIR FARDUNJI (First Assistant to the Imperial Mycologist). — *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 3, 14 pp., 1 plate. Calcutta, April 1915.

Late blight of potato, due to *Phytophthora infestans* (Mont.) De Bary, is fortunately not prevalent in India except in the hills. The first outbreak in the plains was reported in 1899-1900 from some villages in Bengal. After three or four years it disappeared and was not again recorded till 1912-13, when it worked havoc with the potato and tomato crops at Rangpur (Bengal) and with potato at Bhagalpur (Bihar).

The appearance of the disease in this latter locality may be attributed to the use of seed-potatoes from Darjeeling and Naini Tal, where the fungus is known to be present. At Bhagalpur the fungus appeared in such virulence that entire fields were destroyed in a fortnight after damp weather.

It was found that seed potatoes harvested in the diseased fields of Bhagalpur gave healthy crops the following season, even if they were sown in fields which had been infected by the parasite the previous season.

These experiments and the death of pure cultures of the fungus during the summer showed that the heat of the plains is sufficient to kill the parasite. Seed potatoes from infested localities should therefore be obtained in time to enable them to pass part of the summer in the plains.

In pure cultures on artificial media the writer has observed the formation of globoid or pyriform swollen bodies, with smooth, amber-coloured walls, borne laterally or terminally on very broad stalks. These bodies are considered as resting conidia or chlamydospores, similar to those found in *Pythium palmivorum* Butl., in *Phytophthora parasitica* Dast., in *Ph. colocasiae* Rac. and in *Ph. faberi* Maubl., and not as parthenogenetic oospores (1).

563 - **On Red Rust of Tea produced by an Alga (*Cephaleuros virescens*) in Java.** — I. – BERNARD, CH.: "Red Rust", eene ziekte van de thee plant veroorzaakt door *Cephaleuros virescens*. — II. – KERKHOVEN, A. R. W.: Eenige observaties betreffende de "Red Rust" op de theeheesters. — *Mededeelingen van het Proefstation voor Thee*, No. XXXII. Buitenzorg, 1914.

I. — During recent years, and particularly in 1914, the climate of Java was characterised by a very severe and prolonged drought. The various crops, and especially tea, suffered very much in certain districts from these abnormal conditions. Owing to weakened vitality they were not able to resist the attacks of a series of animal and plant pests.

The first damage was caused by *Helopeltis*, which aggravated the weakness of the bushes. This was followed by the attacks of various crypto-

(1) See *B.* Dec. 1912, No. 1680; *B.* Sept. 1913, No. 1099. (*Ed.*).

gamic parasites, the most dangerous being *Cephaleuros virescens* (1) long known as " Red Rust ". This alga is certainly indigenous to Java and occurs on the leaves of many plants. Though it cannot be said that any tea-plant is free from this parasite, yet when the bushes are vigorous its filaments only penetrate the old leaves, on the surface of which are formed the orange-coloured spots containing the reproductive organs of the alga. In these conditions the parasite only causes insignificant damage, the health of the plant not being affected, and the yield is therefore not diminished. But as soon as exterior circumstances change the vigour of the bushes, the filaments of the alga penetrate the small shoots and thence reach the older branches. The leaves fall and the branches die back to a greater or less distance, giving the plantation a very characteristic miserable appearance. Further, the diseased bushes produce no fresh growth and the yield is thereby considerably reduced. Except in the case of very young ones, the infected bushes do not generally succumb to the attack of "red rust"; when the conditions of growth become favourable again, the lower branches throw out new growth, which, with proper pruning, may reconstitute vigorous and productive bushes.

It is thus important to determine the factors which affect the vigour of the plant and so favour outbreaks of the disease. The writer therefore proposes to undertake a complete study of this parasite, both from the macroscopic side (*i. e.* its effects on the host plant) and from the microscopic side (systematic and biological description of the alga). The data here given are only of a preliminary nature and concern only certain practical observations on the spread of the disease.

Besides the long periods of drought, the principal factors which have contributed to the great development of the disease in recent years are: owing to the great increase in the area under tea cultivation and the more intensive cultivation practised, lands exhausted by erosion or by previous cropping have been planted; lack of hand labour, and consequent neglect of cultivation; importation of seed belonging to inferior varieties; finally, the premature picking of young trees owing to financial difficulties.

Various experiments have shown that fungicides and insecticides are without effect against the filaments of *Cephaleuros*, and further that heavy pruning is not effective in clearing the disease from a plantation. It follows that only indirect measures can be taken, *viz.* measures which tend to improve the conditions of growth and which follow from the previous observations. As soon as the disease is observed in a garden the plants should be given a prolonged rest, no picking or pruning being done until they have recovered their full vigour. At the same time the soil should be carefully worked over and every means adopted to prevent erosion, such as the formation of terraces and an appropriate system of drains and ditches. If possible suitable manures should be applied and leguminous cover crops should be planted between the rows of bushes, which in addition to their manurial effect will also provide shade and mitigate to some extent the

(1) See also *B.* Nov. 1914, No. 1072. (*Ed.*)

effects of the drought. Other parasites must also not be neglected; *Helopeltis* must be kept in check by hand-picking, and prunings should be burnt so as to destroy eggs and dangerous spores. Lastly, picking should be done with great care on young plants or those shooting fresh after cutting back, for very often it is bushes treated badly when young which first become attacked by parasites.

II. — During the last three years the writer has observed that the branches may die from this disease and that protuberances and longitudinal cracks appear on the bark. Young vigorous plants in virgin soil are also attacked and whilst they are able to resist and finally recover, weak plants recover slowly and often suffer permanent damage.

Old branches with grey bark are rarely attacked, young vigorous shoots being the most vulnerable. It is possible that the algal filaments penetrate to the cambium in the longitudinal cracks caused by the rapid growth of these young shoots.

The writer tried spraying with Bordeaux mixture, but the results were insignificant and when heavy rains came on some other treatment had to be found. He next attacked the predisposing cause of the disease, in this case *Helopeltis*. All the children obtainable were put onto a single plantation of about 24 acres, where they succeeded in collecting over 4 million insects. The result, however, was perfectly negative, and the plantation after this year of trial was absolutely black as if scorched. This costly method was therefore abandoned.

Dr. BERNARD, in his report on a journey in the tea districts of India and Ceylon, remarked that the different tea diseases were less frequent in the districts where the plantations were well kept and manured regularly. The writer had also observed the same thing in Ceylon, and therefore set about improving the conditions of growth in the plantations attacked by *Helopeltis* and red rust, by regular cultivation and manuring.

The appearance of the plantations improved rapidly and in a surprising manner, although *Helopeltis* was still present. The damage caused by the insect was much reduced and the virulent form of red rust on the large branches disappeared almost completely.

Two plantations were severely attacked in 1912 and 1913. No. 1 was given 3 ½ oz. of "boengkil" (earthnut cake), containing 7 per cent nitrogen, per bush at the beginning of 1913 and half that amount in May-June 1914. No. 2 received 3 ½ oz. of cake towards the end of 1913 and later an ounce of superphosphate.

The soil of the two plantations, which was in a deplorable condition, was well tilled towards the end of 1912. The mosses and various parasites and epiphytes were removed from the trunks and the ends of rotten branches were cut away during the pruning early in 1914.

Taking the yield of tea in 1911 as 100, the figures for the next three years are as follows:

	1911	1912	1913	1914
Plantation No. 1 (60 acres)	100	74	83	150
» No. 2 (24 acres)	100	77	70	111
For the whole of the plantations (710 acres)	100	83	66	128

(Plantation No. 2 dit not recover completely till towards the end of 1914).

The writer's observations may be summarised as follows :

1) " Red rust " on old leaves does not cause any damage.

2) When the disease affects the branches it is dangerous, especially for young and delicate plants.

3) Spraying with Bordeaux mixture is not efficacious.

4) At present no direct remedies are known for red rust ; indirect measures consist in improving the conditions of life of the plants so as to give them increased resistance.

5) Red rust attacks young as well as old plants.

6) Good varieties of Assam tea are as susceptible as poor varieties, and being more delicate suffer more.

7) Young vigorous shoots are more liable to attack, so that the danger of infection is greater after severe pruning.

8) The pruning of infested branches is of value, especially when *Helopeltis* is diminished.

9) The damage is worse in the dry season, probably owing to decreased vitality of the bushes.

MANN and HUTCHINSON have said that red rust is a disease of weak plants. The writer believes rather that it is a general disease from which weak plants suffer most.

WEEDS AND OTHER INJURIOUS FLOWERING PLANTS.

864 - ***Cuscuta racemosa* and *C. arvensis* in Russia** (1). — MALTSEV, A., in *Bulletin of Applied Botany*, Year VIII, No. 3 (78), pp. 257-275, plate 129, figs. 890-891. Petrograd, 1915.

In Russian agricultural literature there are several references to the presence of American dodders and particularly of *C. racemosa* Mart. in clover and lucerne seed, especially in imported seed. The question of the distribution of *C. racemosa* as a weed in Russian crops had not been previously worked out ; no specimen from Russia was to be found in any herbarium.

In the summer of 1914 the Bureau of Applied Botany received from the province of Mogilev some herbarium specimens of *Cuscuta* which had been collected in clover near the village of Slasteny in the district of Tshauskii. The clover seed had been bought at Mogilev, to which it had been brought from Riga, so problably it was of foreign origin. After a careful examination of these specimens, the writer arrived at the conclusion that some of them belonged to *C. racemosa* and some to *C. arvensis* Beyr. It is therefore possible to affirm the existence of American dodders in Russia.

(1) See also : *B.* May 1911, No. 1553; *B.* July 1911, No. 2316; *B.* Aug.-Sept.-Oct. 1911, No. 3009; *B.* Jan. 1913, No. 75; *B.* June 1913, No. 758; *B.* Dec. 1913, No. 1402. (*Ed.*).

865 - ***Matthiola humilis* and *Sisymbrium irio* as Weeds in Egypt** (1). — BOLLAND, B. G. C., in *The Agricultural Journal of Egypt*, Vol. IV, Part II (1914), pp. 127-128, 2 plates. Cairo, 1915.

Matthiola humilis D. C. and *Sisymbrium irio* L. are both common weeds in Egypt. The former flowers from February to April and occurs in barley fields along the Mediterranean coast. The latter flowers from January to March and grows in ditches and on all cultivated soils.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

866 - **New Thysanoptera in Florida.** — WATSON, J. R., in *Entomological News*, Vol. XXVI, No. 2, pp. 49-52, plate II. Philadelphia, 1915. GENERALITIES

The writer gives systematic descriptions of: *Cryptothrips pini* n. sp., common on the needles of young or old pines; *Heterothrips aesculi* n. sp., on the flowers of *Aesculus pavia*; *Euthrips tritici* var. *projectus* n. var., very common on flowers of orange, tomato, rose, begonia and numerous Compositae and also on the needles of seedling pines.

The writer adds that he has received from Ceylon a species which appears to be identical with *C. floridensis*, thus notably extending the area of distribution of this thrips.

867 - **Scale-Insects observed in England in 1914** (2). — GREEN, E. ERNEST, in *The Entomologist's Monthly Magazine*, Vol. LI (Third Series, Vol. I), No. 5, (No. 612), pp. 175-176 - No. 6, pp. 177-185, 1 fig., plates XV-XVII. London, May and June 1915.

The scale-insect found by the writer on *Betula* at Camberley (Surrey) and described as *Kuwania britannica* in 1914 is now identified with *Steingelia gorodetskia* Nassonow, found in Russia. The writer still maintains that it belongs to the genus *Kuwania*, the differences being perhaps sufficient to allow of the erection of a sub-genus, so that the name would stand as *Kuwania* (*Steingelia*) *gorodetskia* (Nassonow).

Also the *Eriococcus* collected on *Erica* in the same locality is now found to correspond to *Eriococcus devoniensis* Green. This scale lives on wild *Erica cinerea* and allied cultivated forms in gardens, where it has been a veritable pest, some plants being so thickly infested that they had to be destroyed.

The following scales are also mentioned:

1) *Eriococcus insignis* Newst., occurs commonly on *Agrostis* sp., in the Camberley district.

2) *E. greeni* Newst., not uncommon at Camberley with the preceding species.

3) *E. inermis* sp. nov., associated with the above two species on *Agrostis* (*setacea?*) at Camberley and Virginia Water (Surrey).

(1) See also *B.* Oct. 1914, No. 963. (*Ed.*).
(2) See also *B.* May 1915, No. 561. (*Ed.*).

4) *E. lagerstroemiae* Kuwana, found by J. C. F. FRYER on *Lagerstroemia* in the open in a nursery at St. Albans (Herts); this insect was introduced from Japan where it is indigenous.

5) *Pseudococcus pulverarius* Newst., on *Agrostis* sp., at Camberley.

6) *P. sphagni* n. sp., discovered by H. DONISTHORPE in nests of *Formica picea* in sphagnum at Matley Bog, New Forest (Hants).

7) *P. gahani* sp. nov., on *Ribes*, in London.

8) *Phenacoccus aceris* Sign., abundant on *Ulex europaeus* at Camberley.

9) *Cryptococcus fagi* Baerensp., frequent on *Fagus* near Camberley.

10) *Fonscolombia fraxini* Kalt., abundant on *Fraxinus excelsior* at Woking (Surrey), Goring-on-Thames (Berks) and Bearsted (Kent).

11) *Kuwanina parvus* Mask., collected by FRYER on branches of cherries imported from Japan, where the insect is indigenous, in a nursery at St. Albans.

12) *Newsteadia floccosa* Westw., common under mosses, among heather and under the shade of pines at Camberley.

13) *Pulvinaria vitis* L., on young trees of *Betula*, on *Tilia*, and on a *Camellia* at Camberley.

14) *Lecanopsis brevicornis* Newst., abundant on *Agrostis setacea* at Camberley.

15) *Eriopeltis festucae* Fonscol., at Arundel (Sussex) and near Camberley.

16) *Chionaspis salicis* L., abundant on *Cytisus scoparius* at Weybridge (Surrey).

17) *Diaspis pentagona* Targ., discovered by FRYER on cherries imported from Japan.

18) *D. persimilis* Ckll., on *Sideroxylon marmulano*, under glass at Kew.

19) *Mytilaspis ficus* Sign., on branches of the common fig.

20) *Parlatoria pergandei* Comstock, found by FRYER on plants of *Citrus* in a nursery at Kingston.

MEANS OF PREVENTION AND CONTROL

868 – **New Species of *Aphelinus* parasitic on Scale-Insects.** — RUST, E. W., in *Entomological News*, Vol. XXVI, No. 2, pp. 73-77. Philadelphia, 1915.

The writer describes the following Hymenoptera as new to science:

1) *Aphelinus capitis* n. sp., reared from *Aspidiotus hederae* on *Hedera helix* and on *Nerium oleander*; from *A. camelliae* on *N. oleander* and on *Schinus molle*; from *Aspidiotus* sp. on *Pinus radiata*; from *Chionaspis pinifoliae* on *P. radiata*; and from *Aulacaspis zaminae* on *Cycas revoluta*, in various localities in California.

2) *A. quaylei* n. sp., reared from *Pseudaonidia articulatus*, *Hemichionaspis minor* and *Aspidiotus camelliae* on various hosts, in Peru; also reared from *Chrysomphalus aurantii* and *C. aurantii citrinus* on *Citrus* in California.

3) *A. limonus* n. sp., obtained from *Hemichionaspis minor* on *Cajanus indicus* at Honolulu (Hawaii).

869 - **The Coccinellid *Cryptolaemus montrouzieri* for the Control of Scale-Insects on Coconuts in the New Hebrides.** — LARGEAU, F., in *Revue Agricole*, No. 45, pp. 59-60. Noumea, 1915.

Several species of scales are common in the coconut plantations in the New Hebrides.

With a view to checking the spread of these pests, specimens of *Cryptolaemus montrouzieri* have been recently introduced direct from Australia. This lady-bird, indigenous to New Caledonia where it devours the scales attacking *Araucaria*, has already begun the destruction of coconut scales, and gives promise of the same useful results that have followed its introduction into other countries against other scale-insects (1).

870 - **On the Biology of *Aleochara bilineata*, a Beetle parasitic on *Chortophila bassicae*** (2). — WADSWORTH, J. T., in *The Journal of Economic Biology*, Vol. 10, No. 1-2, pp. 1-27, fig. A, plates I-II. London, June 1915.

This work, carried out by the section of Agricultural Entomology of the University of Manchester on materials collected during 1914 (except April and May) and the early part of 1915 near Northenden and Sale (Cheshire), concerns the biology of the beetle *Aleochara bilineata* Gyll. (fam. *Staphylinidae*), the larvae of which are parasitic on the pupae of the cabbage root-fly (*Chortophila brassicae* Bouché). A detailed description is given of the eggs, larvae, pupa and adult.

The larvae leave the egg with the characteristic appearance of Staphylinid larvae, active and campodeiform. They penetrate the puparia of *C. brassicae* and after the first moult they reappear as eruciform larvae. Thus, as a result of their parasitic mode of life, they undergo a simple form of hypermetamorphosis. During the larval stage they moult three times. It was thought by other writers either that the eggs were laid in the fly-larvae or that the larvae of the parasite attacked the fly-larvae, but this has been shown not to be the case. After the first moult the larvae are very voracious. Pupation takes place in the puparium of the host.

There are two broods in the year in the Manchester district, and it may well be that in warmer climates three or even more occur. The adults of the first brood appear in May and June, the insect having entered the larval state during the late autumn of the previous year. The individuals of this brood appear to require from 8 to 9 months to complete their metamorphosis. The adults of the second brood leave the puparia of the host in August and September. This brood takes only six or seven weeks to complete its life-cycle. By keeping the winter larvae in warm chambers their period of development may be considerably shortened.

The writer believes it possible to find other species of *Aleochara* with a similar life-cycle, with certain slight differences. It is also possible that *A. bilineata* may live as a parasite on other Diptera.

Of 2189 puparia examined, 239 or 10.9 per cent were found to be parasitised by this beetle. During summer the parasitism reached 26.9 per cent.

(1) See *B.* July 1914, No. 697. (*Ed.*).
(2) See *B.* July 1915, No. 772. (*Ed.*).

It was estimated that at least 20 per cent of the larvae and pupae of C *brassicae* in the district in question must be destroyed by Coleopterous o Hymenopterous parasites.

Considering the great damage done by this fly and the difficulty o finding suitable means of checking it, the writer believes that more atten tion should be paid to the multiplication of its natural enemies.

871 - ***Cirrospilus ovisugosus* n. sp. (*Hymenoptera*), Natural Enemy of th Four-lined Leaf-Bug (*Poecilocapsus lineatus*).** — CROSBY, C. R., and MATHESON ROBERT, in *The Canadian Entomologist*, Vol. XLVII, No. 6, pp. 181-183, figs. 14-17 London, Ont., June 1915.

In examining the stems of *Weigelia* containing the eggs of the four lined leaf-bug at Ithaca (New York), the writers observed that the lower en of several eggs had been removed and their contents extracted by a smal Hymenopterous larva. This larva bores the pith of the stem until i reaches the row of eggs of the leaf-bug, upon which it feeds, destroying thre or four. Frequently two larvae may attack the same row of eggs from oppo site ends, thus destroying them all. About 50 per cent of the eggs in th stems of *Weigelia* were found to be attacked by this parasite.

The larvae reach full size before the cold weather sets in, but do no pupate till the following spring.

Observations made in February 1914 showed that the larvae of th parasite were found in cavities of the pith near the eggs of their host an sometimes at a short distance from the eggs, actually boring further into th pith. After about a week the larvae pupated, and the adults emerged abou March 23.

The writers describe the parasite as a new Chalcid under the name o *Cirrospilus ovisugosus*.

INSECTS, ETC., INJURIOUS TO VARIOUS CROPS

872 - ***Tylenchus devastatrix* attacking Beans in Sicily.** — COCUZZA-TORNELL FRANCESCO, in *Il Coltivatore*, Year 61, No. 16, pp 496-499. Casale Monferrato, June 10, 191

In March 1915 it was reported that in two localities of the province o Girgenti eelworms (*Tylenchus devastatrix* Kühn.) were causing seriou damage to beans (*Vicia faba*), which are a very important crop in Sicily. Th attack has also been reported from other parts of the island, but not ever year. The damage produced is known locally as "mali niuru" (blac disease).

The writer describes the parasite, the nature of the damage and th means generally employed to control the pest (1).

873 - ***Aphanus sordidus* attacking Earthnuts in Konkan (Bombay).** — DESPHAND V. G., and RAMRAT, S. KASARGODE, in *The Poona Agricultural College Magazine*, Vol. V No. 3, p. 200-201. Poona, 1915.

The earthnut (*Arachis hypogoea*), which has recently been introduce into the Konkan, shows great promise of being extensively grown in th future.

(1) See *B.* June 1911, Nos. 1941 and 1991; *B.* April 1913, No. 437; *B.* Aug. 1913, No. 100 *B.* Jan. 1914, No. 86; *B.* Sept. 1914, No. 867. (*Ed.*).

In 1914 the crop sown in June ripened towards the end of September and gave a splendid yield. As rain threatened, the crop was immediately dug up and collected in heaps in the fields. Immediately the separation of the pods had begun, a large number of individuals of *Aphanus sordidus* Fabr. appeared and the crop was destroyed in a few days.

This Lygaeid bug, which only attacks earthnuts after they have been dug up from the soil, is a special parasite of oleaginous seeds and is common on the threshing-floors to which the crop is transported immediately after harvest. It sucks the oil from the seeds by inserting its rostrum. The pods appear intact externally, but the seeds have been sucked dry and crumble to powder under slight pressure. Germination tests with such seeds are always negative.

The insect is easily controlled by collecting the pods from the plants immediately after unearthing and storing them in strong sacks of close mesh. Being unable to enter the sacks, the insect can only attack the outer layer of pods.

As the insect is only able to fly with difficulty, the young nymphs and adults may be easily collected by sweeping the soil.

Sesame (*Sesamum indicum*) and saffron (*Carthamus tinctorius*) are also attacked in the same manner as earthnuts.

374 – **Scarabaeid Larvae ("Cane Grubs") attacking Sugarcane in Australia.**— GIRAULT, A. A., and DODD, A. P., in *Queensland, Bureau of Sugar Experimental Stations, Division of Entomology, Bulletin* No. 2, pp. 3-60. Brisbane, 1915.

This paper gives the preliminary results of investigations on "Cane Grubs" begun by the Government in 1911. The first portion contains a key for the identification of larvae and descriptions of the larval stages of some species already determined and others not yet identified and consequently indicated by numbers. These are: *Xylotrupes australicus* Thomson; *Dasygnathus australis* Boisd.; No. 678; No. 71; No. 349; *Calloodes greyanus* White (No. 655); *Repsimus aeneus* Fabr. (No. 434); No. 576; No. 539; *Lepidiota frenchi* Blackburn (No. 533); *Lepidiota* sp. No. 377; *Lepidiota* sp. No. 666; *Lepidiota* sp. No. 215; *Lepidiota* sp. No. 89; *Lepidiota* sp. No. 45; No. 650; No. 667; No. 607; No. 653; No. 609; No. 646; No. 587; No. 671; Cetonid No. 46; No. 364.

Among the species not yet determined are included: No. 369, which belongs to the manure-feeding group; No. 576 is probably *Horonotus optatus* Sharpe, whilst the small species Nos. 650, 653, 587, etc., are probably *Haplonycha*, *Liparetrus* and other small Scarabaeids. The insect described as *Lepidiota* sp. No. 89 is perhaps nearer the genera *Anoplognathus*, *Calloodes*, *Repsimus*, etc., than the genus *Lepidiota*.

In the second part are collected data obtained during the last three years on the different phases of development and habits of the following beetles injurious to sugarcane: *Lepidiota albohirta* Waterhouse; *L. frenchi* Blackburn (No. 533); *Lepidiota* sp. No. 666; *Lepidiota* sp. No 45; *L. froggatti* Macleay; *Lepidiota* sp. No. 215; *Lepidiota* sp. No. 377 (probably *L. rothei*); *Lepidiota* sp. No. 89; *L. darwini* Blackburn; *Isodon puncticollis* Macleay; *Haplonycha* sp. (near *H. bella*); *Haplonycha* sp.; *Dasygnathus australis*

dejeani Macleay; *Cacachroa decorticata* Macleay; Cetonid No. 46; No. 71 No. 539; No. 349; *Xylotrupes australicus* Thomson; *Calloodes greyanus* Whit (No. 655); *Repsimus aeneus* Fabr. (No. 434); No. 576; *Anoplognathus boisduva* Boisd.; No. 671; No. 667; No. 653; No. 646; No. 607; No. 609; No. 364 No. 587; No. 650; *Anomala australasiae* Blackburn; *Pentodon austral* Blackburn; *Mastochilus australasiae* Perch; *Cladognathus torrensis* Deyr *Neso planicollis* Blackburn; *Liparetrus atriceps* Macleay; *Semanopterus d pressiusculus* Macleay and *Horonotus optatus* Sharpe.

875 – **The Sucking Mechanism of *Lecanium viride* on Coffee.** — KEUCHENIUS, P. F in *Teysmannia*, Year XXVI, Part 1 and 2, pp. 62-76. Batavia, 1915.

The green scale (*Lecanium viride*) is one of the worst enemies of coffe in Java. It retards the growth of the plants, causes deformity of the leave and diminishes the yield. In a severe attack some of the branches may b destroyed. During the rainy season, however, most plants recover.

The rostrum of the insect is found to consist of two canals, one of whic is used as a sucker and the other as a duct for the saliva which is secrete by two glands and by its hardening properties serves to maintain the sucke in position.

The epidermal cells of the plant perforated by the sucker do not los their turgescence or die. The sucker works its way through the tissue until it reaches the phloem, and in particular the cells of a medullary ray which are exhausted of their contents. The insect then seeks a neigh bouring medullary ray, leaving traces of the passage of its sucker in th form of solidified saliva.

Most damage to the plant is done by the death of the medullary ra cells, as transportation of food materials is hindered.

876 – **Experiments on the Parasitism of *Heterodera radicicola* on Coffee Brazil** (1). — BONDAR, GREGORIO, in *Secretaria da Agricultura, Commercio e Obras publi do Estado de São Paulo, Boletim de Agricultura*, Series 16, No. 4, pp. 329-330. São Paulo, 191

In the agricultural literature of Brazil *Heterodera radicicola* is referr to as the cause of considerable damage to coffee in that country. The writ has visited numerous plantations in various parts of the country and h never been able to find this nematode on the roots of coffee. The parasi is widespread in Brazilian soils and attacks the roots of several cultivat and wild Leguminosae, Solanaceae, Malvaceae and other field and gard crops, though in these same soils coffee appears to be free from attack.

In May 1914 the writer carried out experiments in artificial infecti of coffee with this nematode. In these experiments 16 pots were use each containing 3 coffee plants; eight pots were filled with soil from a coff plantation and eight with a humous wood soil. Four pots of each seri were used as controls and the other four pots were abundantly infect with the nematode by means of diseased roots of tomatoes, pine apples a Leguminosae mixed together and placed among the roots of the coff plants.

(1) See also *B.* April 1912, No. 575; *B.* Jan. 1913, No. 86. (*Ed.*).

After eight months all the plants were growing normally (except a few which had started badly) so that the infected pots could not be distinguished from the controls. Examination of the roots showed then to be quite normal and without traces of eelworms.

The writer concludes that under normal conditions the nematode never attacks coffee. Reports as to the existence of this parasite on coffee generally relate to heavily-shaded nurseries with damp soil, under which conditions the young unlignified roots of the plants are in a more favourable state for attack.

877 - ***Adrama determinata* attacking Tea Seeds in Java.** — LEFFMANS, S., in *Mededeelingen van het Laboratorium van Plantenziekten*, No. 12, pp. 1-15, 2 figs. Buitenzorg, 1915.

A number of specimens of a fly causing damage to tea seeds during germination were received at Buitenzorg from a tea estate at Tjibadak. The insect was identified as *Adrama determinata* Walk., considered by the most recent authorities, BEZZI in particular, to belong to the *Trypetidae*.

It was also observed in the neighbourhood of Tjibeber (Preanger, Java) where its life-history was studied in detail. The insect developed on some seeds which had been dried before packing for export. In order to be certain that the insect was responsible for the damage, a certain number of individuals were placed in contact with seeds in different stages of maturity and germination. After a week it was observed that larvae occurred only in the seeds which had germinated and burst and that the seeds with their evelope intact had not been attacked.

The white torpedo-shaped egg measures about 1 ¼ mm. by ¼ mm. It is deposited in the cotyledon after the seed-coat has burst. The individuals reared from the layings of two females numbered 40 and 48. The egg hatches after 2½ days and the larval stage lasts from 9 to 12 days. The larva measures 7-8½ mm. in length and has the power to jump. The cotyledons are bored from side to side by the larvae, causing the seeds to rot, so that they seldom produce seedlings. The larva then abandons the seed and pupates in the soil within a yellowish-brown puparium 7 mm. by 2 mm., from which it emerges after 12 to 15 days. The complete life-cycle thus takes 26 or 27 days. Adults have lived as long as 26 days.

The insect measures about 11 mm. long ; the body is slender ; in colour it is black with yellowish-brown patches, the wings having dark bands. The sexes are easily distinguished by the shape of the abdomen, that of the male being obtuse, while that of the female is prolonged into a horned point containing the ovipositor.

From *a priori* reasons it appears that this insect would not be able to attack seeds buried at a certain depth in the soil. Experiment has actually shown that a very thin layer of soil protects the seeds against their attack. This simple measure should therefore be adopted in the germinating pans.

Up to the present the insect has only been recorded on two estates. It is possible that it has only recently begun to attack tea seeds or perhaps the failure of seeds to germinate is attributed to putrefaction and moulds when the real cause is this insect. It has not yet been noted if the open

cotyledons of seedlings are attacked by the larvae. This would not be serious, since vigorous seedlings may outgrow such an attack.

In all cases it is advisable to take precautions with seeds already partly germinated. Seeds with the seed-coat more or less bursting open should be placed in separate germinating pans and covered with fine metallic gauze so as to trap the insects as soon as they appear.

878 - **Experiments on the Destruction of Fruits infested with the Larvae of Fruit-Flies.** SEVERIN, HENRY H. P., in *Entomological News*, Vol. XXVI, No. 2, pp. 78-83, 1 fig. Philadelphia, 1915.

Experiments were undertaken by the writer to test some of the methods already suggested for the destruction of fruits attacked by fruit-flies, especially *Ceratitis capitata* Wied. (1), *Anastrepha ludens* Loew (2) and *Dacus cucurbitae* Coq. The burying of the damaged fruits under a layer of soil 3 feet deep appeared to involve too much labour. If the method proposed by MALLY in South Africa of covering the fruits with a layer of compressed soil 10 inches deep can effectively prevent the escape of the flies, it would be the most economical and practical method for the destruction of infested fruits, as well as a means of increasing the fertility of the soil.

The immersion of the fruits in water for 4 days would be very effective, provided the damaged fruits were collected daily and immersed.

These two methods could be combined with advantage. The damaged fruits should be collected each day, and thrown into a barrel or cistern of water; as the fruits accumulate they should be buried. This would avoid digging holes and covering with soil each day. Nevertheless in extensive orchards the daily picking of infested fruits would involve considerable labour.

(1) See *B.* June 1915, No. 670.
(2) See *B.* March 1913, No. 319. (*Ed.*).

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

"Red Soil"

by

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It may be said that *red soil* is at once confined to Karstic country and almost the only type of soil which occurs in such country. Thus, besides its scientific importance as a highly characteristic soil, it is of great interest in the agricultural economy of certain regions, generally poor in water and vegetation. Karstic limestone mountain country would indeed be desolate if its naturally sterile rock were not covered here and there by extensive deposits of red soil.

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The origin of red soil has been the subject of considerable discussion. In some cases this has been due to lack of agreement on the part of different investigators as to the exact definition of the term. The lithologist considers red soil as a quite distinct and unique formation capable of scientific definition, while the geologist is more inclined to give it a less restricted definition by bringing in considerations of position and origin; the agriculturist will mean by "red soil" any red or brown agricultural soil clothing limestone rocks in regions of a Mediterranean character, having certain well-known cultural characters, without any stipulation as to its mineral composition or origin.

The oldest and most generally accepted opinion has been that red soil is the residue from the decomposition of the limestones upon which it rests. Advocates of this theory are ZIPPE, BOUÉ, TIETZE, FUCHS, NEUMAYR,

and more recently among Italians TARAMELLI and DE GIORGI, both of whom previously held different views. In opposition to this we have STACHE followed later by KRAMER, for whom red soil represents the degradation and rearrangement of older ferruginous clays. The theory formerly upheld and then abandoned by TARAMELLI that red soil is derived from volcanic sands or mud eruptions has recently received a fresh exponent in SCHIERL.

For a length of time there were no more discussions *ex professo* on red soil and its origin. When the question was again raised by me in 1904 I maintained that in the formation of red soil ferruginous colloidal solutions played a great part. After the publication of my note lithologists and geologists again took up the subject. Among the former TUĆAN was of opinion that the red soil of the Karst was the insoluble residuum of the limestones upon which it rests. TUĆAN's memoir is interesting because he proves that the same mineral residues that are found in the limestones are found also in the residues of the red soil, which according to him is a formation characterised by the mixture of several colloids. A colloid hydroxide of aluminium, sporogelite, is predominant and is followed by silicic acid and iron oxides and hydroxides, also colloidal. It is to these ferruginous colloids that the aluminium colloid owes its red colour. The rest of the red soil is formed by a little limestone and fully twenty seven different mineral species. Now TUČAN has proved, by means of numerous preparations, that in the insoluble residue of the Karst limestone on which the red soil lies, all the minerals which are observed in the red soil are found in the same order of frequency and with the same mineralogical facies. It would thus seem to be demonstrated without a doubt that the red soils analysed by TUĆAN are really the degradation residues of the limestones. TUĆAN, however, did not give any answer to WALTER's objection, raised again by me, and the point was not easy to explain, namely why did the water which altered such a mass of limestone, hundreds of cubic yards of which may be judged necessary to give any appreciable residue of red soil, owing to the relative scarcity of the material, leave *in situ* the red soil which was gradually formed. This same objection was made by GORTANI, who concludes, after adopting and developing my hypothesis, that it is a question connected with colloids. TUĆAN himself subsequently accepted this idea but only for certain red soils which, however, he did not consider to be the real "red soil" in its lithological sense.

GALDIERI, on the other hand, in an important monograph on the red soils of Southern Italy, strenuously advocates the theory that red soil is essentially of aeolian origin. A capital argument against TUČAN's theory is the fact observed by GALDIERI that the minerals contained in the red soil are of greater dimensions than those contained in the limestone residues. Derivation of the larger particles from the smaller ones is simply absurd.

In conclusion it is becoming more and more probable that what I said in my above-mentioned work was true, namely that there are similar but not identical types of red soil and that they may have various origins; in nature the same effect is not always produced by the same cause. There are therefore red soils of different compositions, more or less ferruginous

or calcareous, or rich in alumina, produced either by direct or by indirect weathering of the limestone or by aeolian action. The fact remains, however, and it is an important one from an agricultural point of view, that red soils, at least in their most typical manifestations, such as those of the Karst, must be considered as of a prevailingly colloidal type of formation.

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Though much has been written on the origin of red soil, but little is known about its chemical composition, since the available analyses are far from numerous. The oldest are those of REITLECHNER, which were published by LORENZ V. LIBURNAU. They refer to red soils without any special indication as to locality, and they are not of much use as they take no account of the part which is insoluble in acids. Then follow those of VIERTHALER concerning soils from the neighbourhood of Trieste (Basovizza and Cosina). There are analyses of the red soils of the Karst and of Carniola due to SCHIERL and to MONNIER, the latter of which were published by CHAIX. All these analyses are given in full in an interesting but little-known work by FACH, who added some elaborate and carefully discussed analyses of several red soils from Volosca and other non-European localities. Other analyses are due to ZU LEININGEN, and deal with red soils from Abbazia and Laurana in Istria.

The following are some of these analyses of Karstian red soils from various localities:

	I.	II.	III.	IV.
Water and organic matter	11.77	14.02	19.15	17.52
SiO_2	47.78	53.73	35.21	41.98
Fe_2O_3	32.24	8.62	13.20	10.95
Al_2O_3	3.14	21.02	30.26	26.82
Mn_3O_4	1.35	—	—	—
CaO	0.68	0.96	0.72	1.57
MgO	1.37	1.62	1.50	1.11
K_2O	1.15	—	—	0.92
Na_2O	1.56	—	—	0.26
P_2O_5	0.24	—	—	—
CO_2	0.21	—	—	—

I. Red soil from Laurana. Analysed by LEININGEN.
II. » » » Planina (Carniola). Analysed by SCHIERL.
III. » » » Javornik (Carniola). Analysed by SCHIERL.
IV. » » » Volosca. Analysed by FACH.

From the above analyses it will be seen that the differences between the red soils of various localities are not slight. Especially noteworthy is the red soil of Laurana, which is eminently ferruginous and contains very little alumina in comparison with the other samples; this is a further confirmation of the fact that the name of "red soil" is applied to a number of soils differing from each other in their chemical and lithological characters.

* * *

From the pedological point of view we are acquainted only with the well-known characters of the Karst which are contained in every description of the vegetation and crops of this limestone region. There is only one memoir recently published which treats specially of the agricultural qualities of red soils from a scientific point of view. It is due to ROHLAND who, however, as now frequently happens, owing to the lack of the necessary correlation between the different branches of science, ignores completely all the research work of geologists and lithologists upon red soils. It is important however to note that he also, like the geologists and lithologists, concludes in favour of the colloidal nature of red soils. From the agricultural point of view red soil is to be considered as a type of colloidal soil and possesses all the many characteristic drawbacks and few advantages of such soils.

Red soil is plastic, it breaks up easily and allows rain water to penetrate deeply when it is dry, but, on the other hand, as soon as the action of water causes its colloidal constituents to swell, it becomes impervious. Water does not penetrate it any longer, and evaporates at such a rate that, according to STACHE'S observations (*Die Wasserversorgung von Pola*, Vienna, 1889) 75 per cent of the rainfall is lost again by evaporation. To correct the defects of this soil only marl can be used, the good effets of which on clay soils are well known. Fortunately in the Karst and in Dalmatia the necessary material for marling occurs in abundance.

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The Present State of Our Knowledge of the Physiological Significance of the Mycorhizae of Trees

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Everyone interested in plant biology is acquainted with the strange as sociation existing between the absorbent portion of the roots of a very larg number of plants and the mycelium of fungi, which results in the formatio of the special organ to which has been given the name of " mycorhiza ".

It is also well known that the mycelium sometimes invests, like sheath, the terminal portion of the rootlets, only penetrating between th cell-walls of the outermost layers of the cortex (" ectotrophic " mycorhizae while at other times, scarcely any trace of the mycelium is visible on th surface of the root and it develops to a marked extent in the interior of th cells of the cortical tissue (" endotrophic " mycorhizae).

Many botanits have attributed to these formations, which modify mor or less profoundly the structure and function of the absorbing organs of th root, an important part in the nutritive processes of the vascular plant, sup posing absorption of the nutritive solution from the soil to take place in s called mycotrophic plants through the medium of the ectophytic or endo phytic mycelium of the roots.

More particularly as regards the nutrition of forest trees and o humus-loving plants in general, the question has been much discussed an is in fact still being debated, as to whether mycorhizae should be regarde as indispensable, merely useful, injurious, or as simply harmless excre cences, at least under normal vegetative conditions.

The question is a very interesting one and has given rise to numerou important histological and physiological experiments.

The results hitherto obtained have by no means disposed of the pro lem and anyone who had not himself made a special study of the questi would have difficulty in finding his way among the conflicting opinions th have been expressed as to the ecological significance of mycorhizae. may therefore not be out of place to summarise the present condition our knowledge of this subject.

Historical summary. —THEODOR HARTIG (1), towards the middle of last century, was the first to describe the structure of the mycorhizae of certain conifers; but, at the same time, he did not at once recognise their true nature, for he regarded them as being normal roots. It was GASPARRINI (2), who, in 1856 when examining the roots of *Pinus halepensis*, remarked that the tips of those rootlets that were completely or partially without absorbent hairs were covered with thin filaments. He described in hazel and chestnut coral-like rootlets which were enveloped in " contervoid " filaments, without, however, giving any definite opinion as to their nature.

TULASNE (3), in 1862, in discussing the supposed parasitism of the *Elaphomyces*, was the first to put forward the hypothesis that the mycelium of these fungi can enter into symbiosis with the roots of trees.

In 1874, DE JACZEWSKI (4) attributed the dichotomous ramification of th. rootlets of *Pinus cembra* to a mycelium developing usually upon the surface of these organs. In the same year, BRUCHMANN recorded the occurrence on the rootlets of *Pinus sylvestris* of a sort of crust composed partly of cells of the cortex and partly of mycelial filaments. This "crust" described by BRUCHMANN afterwards (1880) received the name of the mycelial sheath (" Pilzscheide " of REESS; " Pilzmantel " of FRANK).

In 1876, in a work on parasitism in *Elaphomyces*, BOUDIER (5) recorded that the species of these fungi with yellow fructifications (*E. variegatus, granulatus* and var. *asperulus*) had hyphae connected with the roots of neighbouring trees, birch, oak and chestnut. The rootlets of these trees were surrounded with these yellowish hyphae which only penetrated into the outermost cellular layer of the cortex. As these rootlets showed abnormal ramification, BOUDIER attributed a deforming, and even parasitic action to the fungus, but considered its effects to be relatively slight, since the mycelium, according to this mycologist, does not destroy the vitality of the root, but seems rather to increase it by giving rise to a greater affluence of nutritive sap. The idea of a symbiotic relationship, already vaguely suggested by TULASNE, acquired greater semblance of probability thanks to BOUDIER's observations. Almost simultaneously, PFEFFER (6) put forward the same hypothesis in still more definite form. RÈSA, in 1877 (7), found swollen rootlets on the beech, the interior of which contained a mycelium; he attached no importance to this fact, regarding the case as merely one of parasitism.

(1) HARTIG, TH.—Vollständige Naturgeschichte der forstlichen Culturpflanzen Deutschlands, 840-51 (*Bot. Zeitung*, 1863).

(2) GASPARRINI, G. — Ricerche sulla natura dei succiatori e le escrezioni delle radici... apoli, 1856.

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(6) PFEFFER, W. — Über fleischfressende Pflanzen und über die Ernährung durch Aufnahme tierischer Stoffe überhaupt (*Landw. Jahrb. v. Thiel*, 1877).

(7) RÈSA, quoted by SARAUW (*Rev. Mycol.*, 1904).

In the following year, MÜLLER (1), when studying the humus of forests described the ordinary mycorhizae of the beech, giving figures of them, bu only showing their external form. MÜLLER was of opinion that the relation between the fungus and the root are comparable to those existing betwee lichens and the branches of the trees upon which they grow; but h regarded the mycelial sheath as the normal piliferous layer of the root, thu repeating the error of interpretation already made by HARTIG.

In 1880, REESS (2) took up the question already considered by BOUDIE regarding the symbiotic relation between the mycelium of *Elaphomyces* an the roots of trees. He confirmed the results of the observations of th French mycologist, showing more precisely the continuity of relationshi between the mycelium of *Elaphomyces granulatus* and that investing th pine rootlets.

While studying the biology of *Monotropa hypopitys*, KAMIENSKI (3 had occasion to observe the rootlets of beeches and other trees which wer associated with the roots of *Monotropa*. These rootlets are described b KAMIENSKI as being covered with a thick homogenous layer formed of mycelium whose hyphae penetrate between the cells of the epidermis an those of the cortex. The cells of the latter tissue are separated from on another by a single layer of hyphae branching repeatedly in the sam plane and which is very visible on the surface of the cell-walls in tangentia sections of the rootlets.

HARTIG more than thirty years previously, had described with grea exactitude this particular appearance of the cell-walls of the cortex of th pine mycorhizae, but he had interpreted it as the result of a network o intercellular canals originating in the cell-walls during their developmen

Thus it is to KAMIENSKI that the merit belongs of having given to wha SARAUW calls "Hartig's network" the interpretation confirmed by subse quent researches. He was the first to describe exactly the structure of th mycorhizae afterwards called "ectotrophic", but he only admitted th existence of mutual relations between the roots and the mycelium in th case of *Monotropa*. In that of humicole trees, he considers the fung growing on roots to be simple parasites.

Contemporaneously with KAMIENSKI, GIBELLI (4), while studying th "ink disease" of the chestnut, mentioned the occurrence on both health and diseased trees of rootlets that were more or less deformed and covere with a mycelial sheath. He described very clearly the external flocculen zone, the internal pseudoparenchymatous zone and finally the portion o the root where the hyphae become intercellular. The long rapidly-growin

(1) MÜLLER, E. P. — Bemerkungen über die Mycorhiza der Buche (*Bot. Zentral* XXVI, 1886).

(2) REESS, M. — Über den Parasitismus von *Elaphomyces granulatus* (*Bot. Zeitung*, 188

(3) KAMIENSKI, FR. — Les organes végétatifs du *Monotropa Hypopitys* (*Mém. de la Soc. n des math. de Cherbourg*, 1884).

(4) GIBELLI, G. — Nuovi studi sulla malattia del castagno, detta dell'inchiostro. B logna, 1883.

rootlets remain free from the fungus. Similar formations have been described by Gibelli also in the case of other Cupuliferae. According to this botanist, the presence of the mycelium is of no importance to the root, as it is not injurious to any appreciable extent under normal conditions of growth of the host plant. Certain parasitic forms, in GIBELLI's opinion, can find a tolerable and tolerated habitat on the roots of healthy plants.

It results from this brief summary, that in the second half of the last century, before FRANK published his theory on mycorhizae, it was only after isolated and often faulty researches, that botanists recognised the strange association between the roots of trees and the mycelia of fungi; while only a few observers had understood the real structure of ectotrophic mycorhizae (KAMIENSKI, GIBELLI) and only a small number had very vaguely suggested the theory of symbiosis (TULASNE, BOUDIER, PFEFFER, KAMIENSKI [to some extent], REESS), while others considered it a case of injurious parasitism (RÉSA, KAMIENSKI [to some extent], MÜLLER) or of tolerated and harmless parasitism under normal conditions (GIBELLI). The researches of these scientists no doubt yielded important contributions to the knowledge of the nature and structure of mycorhizae, but no conclusion of a general nature was drawn as to their biological significance. It is to FRANK that the merit belongs of having considered the problem from a more general and a more interesting point of view, at least in appearance, and one more easily understood and more acceptable to speculative minds. In stating that trees are incapable of absorbing their nitrogenous food from humus, but that this absorption takes place through the action of the mycelium which is in permanent association with their roots, he propounds a fascinating theory, and one opening new fields for remunerative research. The assertion that such an association was a useful one is the essential basis of Frank's theory (1), which is very happily expressed in the word "mycorhiza".

Ectotrophic mycorhizae. — According to this writer, the fungus supplies the tree, in exchange for carbohydrates, with water and nutritive salts and, in addition, nitrogenous substances from the humus. The absorbent hyphae of the investing mycorhizae would seem to play the part of root-hairs. They appear to modify, by their acid and enzyme excretions, the nitrogenous substances of the humus, absorbing these and conveying them to the higher plant in the form of organic compounds of nitrogen with a low molecular weight, or even as ammoniacal salts. FRANK based this theory on the following observations: 1) the constant presence of mycorhizae on forest plants; 2) the abundance of these formations in humous soils of which the nitrogenous substances cannot apparently be utilised by the roots; 3) the insufficiency, or absence, of root-hairs in plants with ectotrophic mycorhizae; 4) the absence of nitrates in the roots of these plants.

The fact that the vigorous growth of young pines cultivated in humus

(1) FRANK, B. — Über die auf Wurzelsymbiose beruhende Ernährung gewisser Bäume durch unterirdische Pilze (*Ber. d. deutsch. bot. Ges.*, pp. 1885). — ID. — Die Ernährung der Kiefer durch ihre Mycorrhizapilze (*Ibidem*, 10, 1892).

where mycorhiza had been formed was in striking contrast with the weak development of other pines grown in sterilised humus without mycorhiza, was interpreted by FRANK as an experimental proof of his assertion.

FRANK'S conclusions have, to a certain extent, been contradicted by later researches [SARAUW, MÖLLER, VUILLEMIN (1)] which have shown that humus is not necessary to mycorhiza formation.

The researches of SARAUW (2) and MÖLLER (3) have shown that the amount of organic substance indispensable to mycorhiza formation is extremely small. Thus in the sandstone soil of the forest of Fontainebleau, mycorhizae abound. According to SARAUW, the decomposing organic remains merely serve for the saprophytic development of the fungus, which attacks the slowgrowing rootlets. Consequently the humus would not be a source of nitrogen on which the higher plant could draw by means of the mycorhiza. The tree would merely tolerate the fungus on account of its inoffensiveness. Some observations would seem to show that the trees, at least during the early stages of their growth, can develop in a normal manner without the assistance of root fungi.

In this connection, SARAUW reminds us that HARTIG was unable to discover mycorhiza on the roots of beeches, oaks, hornbeams and hazels from 10 to 12 years of age in the nursery of forest trees at Munich. Further, MÖLLER obtained with small pines devoid of mycorhiza and growing in acid humus, a much more vigorous growth than with others possessing mycorhiza but growing in sand from the forest subsoil. This demonstrates the autotrophic capacity of trees, even in essentially humous soils; hence, according to the writer, we may conclude that the association is a useless one.

STAHL (4) does not make so definite a denial of FRANK'S theory; he admits the utility of mycorhiza but endeavours to refute FRANK'S idea as to the absorption of the organic nitrogen of the soil.

In the opinion of this writer, mycotrophic plants, especially those which are obliged to adopt this method of obtaining food, are distinguished from non-mycotrophic ones by their weaker transpiration, smaller root development with absence of root hairs, and the occurrence of fewer vascular conducting vessels, which results in the passage of water through the tissues of the plants being very slow. In their leaves, more sugar than starch is formed. The deficient circulation of water, and hence of mineral salts, is compensated, according to STAHL, by the mycorhiza. This would explain why there are no mycorhiza in soils rich in salts. On the other hand, plants that are mycotrophic of necessity grow in soils rich in humus and poor in mineral salts.

According to STAHL, as the fungoid hyphae can absorb the nutritive

(1) VUILLEMIN. — Les Mycorrhyzes (*Rev. gén. des Sciences pures et appliquées*, 1890).

(2) SARAUW G. — Rodsymbiose og Mycorrhyzer saerlirg hos shoostracerne. (*Botanisch Tidsøc.*, 18, 1893).

(3) MÖLLER A. — Über die Wurzelbildung der ein- und zwei-jährigen Kiefer im Markischen Sandboden I. (*Zeitschr. f. Forst- u. Jagdw.* 1902-1903).

(4) STAHL, E. — Der Sinn der Mycorrhyzenbildung (*Jahrb. f. wiss. Bot.*, 34, 1900).

salts of the soil with much greater facility than the roots of higher plants, a struggle for the mineral food substances must take place in the humus between the vascular plants and the hyphae. In this struggle only those plants can survive whose roots are associated with these mycelia. An indirect proof of this, in STAHL's opinion, is to be found in the fact that plants without mycorhiza grow more vigorously in sterilised humus than in humus containing a quantity of living mycelia.

STAHL is only apparently in touch with the real facts of the case when he states that the relative difference in the need of nutritive mineral substances, governed in different plants by mycotrophism, parasitism and the attacks of insects, determines the situation of mycotrophic plants, mycorhiza being rare where nutritive salts are most abundant. A sparse and sluggish circulation of water is accompanied, in the case of many plants, by the formation of mycorhiza and it is very probable that these two factors stand to one another as cause and effect, but not in the compensatory relationship in the sense understood by STAHL, especially in the case of facultative mycotrophic plants. It is indeed well known that the slower the growth of the rootlets, the more easily do they become infected by mycorhiza-forming fungi. Now, in plants with weak transpiration and sluggish circulation the rootlets grow more slowly and are thus more receptive to the mycelium.

This can be observed in facultative mycotrophic plants where the formation of mycorhiza does not occur at the period of maximum growth of the rootlets, but preferably in the autumn. In old plants, in which the growth of the root system is gradually decreasing more and more, the number of autotrophic rootlets is reduced to a minimum, while that of the mycotrophic rootlets is greatly increased. On the other hand, the decrease in the growth of the absorptive mechanism caused in its turn by fungoid infection, and the resulting limited formation of root-hairs, are factors that contribute to the further weakening of the transpiration current, for it has not been shown that a rootlet invested by a mycelium absorbs more water than an autotrophic rootlet provided with root-hairs. The formation of mycorhiza is thus, in all probability, an aggravating circumstance, and not a compensation for the original sluggishness of the water in circulation.

As MC DOUGAL has shown (1), in spring, when the need of water and nutritive salts attains its maximum, the mycorhizae of the preceding year are in course of destruction and the new growths are very few in comparison with the abundant formation of root-hairs (VON TUBEUF) (2).

In order to increase the number of observations and data with a view to broadening the basis of a conception that is perhaps only applicable in isolated cases, STAHL has grouped together both ectotrophic and endotrophic mycorhizae, neglecting the fundamental difference, *viz.*, the presence or absence of hyphae communicating with the soil, which distinguishes the two kinds. Whereas in the case of ectotrophic mycorhizae the relation between the mycelium investing the root and the soil remains constant and active

(1) MC DOUGAL, W. E. — On the Mycorhizas of Forest Trees (*Am. Journ. of Bot.*).
(2) TUBEUF, C. — Die Haarbildungen der Coniferen (*Forstl. naturw. Zeitschr.*, 1896).

throughout the life of the mycorhiza, in that of the endotrophic mycorhiz this connection vanishes practically at the start. It is surprising that t supporters of the theory of a struggle for nutritive salts, according to STAHL conception, should have limited their researches almost exclusively to t endotrophic mycorhizae, which seem to justify this hypothesis far less tha the ectotrophic. As might be expected, the results of these researc have not been very conclusive. WEYLAND (1) went so far as to deny t existence of symbiosis in ectotrophic mycorhizae, and consequently that the function attributed to them by STAHL, solely upon the ground tha micro-chemical reactions have not revealed in the hyphae the presence the phosphorus and potassium they should convey to the roots.

FRANK'S theory thus becomes more or less profoundly modified by the contradictory interpretations of the biological meaning of this symbios On the one hand VON TUBEUF considers that symbiosis is useful in the a sorption of the nitrogen of the humus, and that its importance is negligib as regards the salts and the water, since these can be absorbed by the roo hairs, which continue to develop in spite of the formation of the mycorhiza whereas STAHL, on the other hand, believes that the only object of this sym biosis is the obtaining of the salts, the amount of nitrogen acquired being no consequence.

It might be thought that FRANK'S theory, which contains bot these opinions, could still stand. But the observations of VON TUBEU MÖLLER and SARAUW have brought to light facts, recently confirme (MC DOUGAL), necessitating the exclusion of the idea of absolute depend ence on the part of the higher plant upon the symbiotic fungus for obtai ing nutriment from the soil. But if, on the one hand, it is permissible t regard the symbiosis of the mycorhizae as not indispensable to our fores trees, as has been proved by the satisfactory results of the application mineral manures, we must not, on the other hand, accept without furth proofs the conclusions of SARAUW and MC DOUGAL as regards the enti uselessness of mycorhizae.

Should we be justified in considering as useless to Leguminosae the sym biosis of their roots and nitrogen-fixing bacteria merely from the fact tha it only exists to a very small extent in soil rich in nitrate? Although neith experiments nor observations have proved that in the exchange of nutritiv substances between the root and the mycelium, there is any passage of nitro genous compounds — derived from the more or less modified constituent of the humus — from the mycelium to the root, it is, however, very probabl that the utility of the symbiosis is to be found in the fact that the nitroge nous compounds with high molecular weight composing the organic remain in the soil are thereby rendered assimilable for the roots. [VON TUBEU

(1) WEYLAND, H. — Zur Ernährungsphysiologie mykotrofer Pflanzen (*Jahrb. für wiss Bot.*, 51, 1912).

MAGNUS (1), CZAPEK (2)]. The now clearly-demonstrated absence of nitrates in mycotrophic roots also points to the same conclusion.

One school of opinion regarding the part played by mycorhizae — that which appears as a reaction to the ideas of FRANK — regards this kind of symbiosis as not only useless, but even as injurious to the trees ["Antibiose" of VUILLEMIN (3)].

Some diseases of forest trees have been attributed to the effect of the parasitism of mycorhiza.

The effect of this parasitism has been interpreted in different ways. In general, ectotrophic mycorhizae have been considered from this point of view as indirectly injurious, that is to say, it has been supposed that if organic substances are wanting in the soil, the mycelium of the mycorhizae lives entirely at the expense of the tree, thus increasing the exhaustion caused by the poverty of the soil. Other writers have regarded the parasitic action of mycorhizae in a still more definite sense; the ectophytic mycelium of the tips of the rootlets is thought to invade, not only their tissues, causing death, but also the tissues of the secondary roots in which it sets up active decomposition (4).

While this last hypothesis, as far as adult plants are concerned, has been confirmed neither by direct observation nor by experience (5), the observations of MANGIN (6) and others warrant our concluding, as regards the first suggestion, that in a soil rich in organic substances, the symbiosis between the mycelium and the roots acts in normal fashion and no pathological result is manifested that can be attributed to a parasitic action on the part of the mycorhizae. In a soil devoid of humus, but to which suitable manures have been applied, the fungus of the mycorhizae behaves as a mere commensal, and exerts no dangerous influence. In a soil without humus and unmanured, the mycorhizae may increase the exhaustion of the tree, for they live wholly at the expense of their host, greatly reducing the growth and absorption of the roots, as well as the number of autotrophic rootlets. In this interpretation we find a partial expression of the opinion now held by most plant biologists as to the biological significance of mycorhizae, especially of ectotrophic mycorhizae.

Endotrophic mycorhizae. — FRANK has admitted that the fungus, in the case of endotrophic mycorhizae, gives up its albuminoid substances to the

(1) MAGNUS. — Mycorrhiza, in *Bot. Wandtafeln* by L. KNY, Abt. XIII, *Text zu Taf.* 16-120, 1911.

(2) CZAPEK, F. — Der Stickstoff im Stoffwechsel der Pflanzen, *Erg. d. Phys.*, III, Abt, 1904).

(3) VUILLEMIN, P. — Antibiose et Symbiose (*Ass. fr. p. l'av. d. Sc.*, Paris, 1889).

(4) Cf. DELACROIX in *Bull. Soc. Myc. de France*, XIII, 1897. — PESTANA in *Bull. de la Soc. Portugaise des Sciences natur.*, I, 1907. — DUCOMET in *Ann. Ecole nat. d'Agric. de Rennes*, II, 1909.

(5) NADSON has described a case of mycorhiza parasitism in young oak trees (*Zentralbl. für Bakt.*, 2. Abt, 26, 1910).

(6) MANGIN, L. — Mycorhizes des arbres forestiers (*Nouv. Arch. du Museum d'Hist. naturelle*, 5ème Série, 1910).

higher plant in exchange for the latter's carbohydrates. It has subsequently been definitely shown, by means of histological and microchemical research (1), that the mycelium actually develops its absorbent hyphae in the cells containing starch and the starch undergoes hydrolysis, being subsequently completely absorbed by the fungus. The same researches have shown that after a great development of hyphae rich in albuminoid substances, the latter undergo a process of digestion. These facts are apparently in entire agreement with Frank's theory. But in order to prove that the symbiosis is of use to the higher plant, it would be necessary to demonstrate that the fungus obtains the nitrogen necessary to the formation of its albumen-containing hyphae from without, and not from the root. In the latter case, it would be a question of simple parasitism, more or less tolerated. Further, it has not yet been determined whether the proteolytic enzyme found in the cells of the root, where the digestion of the hyphae takes place, comes from the cytoplasm of these cells or from the actual hyphae which would be subjected after a period of hypernutrition to a process of autolysis. This would not exclude in addition an absorption, by the root, of the nitrogenous products of this digestion; but we are now suggesting a hypothesis rather than stating an actual fact.

A number of scientists have tried to discover whether the symbiotic fungus possesses the property of assimilating atmospheric nitrogen.

One of the first, JANSE, has stated that all endoradical mycelia have this power, but his assertion is only founded on theoretical considerations. Later, HILTNER and NOBBE (2) demonstrated that in *Alnus* and *Eleagnus* an assimilation of atmospheric nitrogen actually takes place by means of the root tubercles; similar experimental proof was also given by the same writers in the case of *Podocarpus* (3). TERNETZ (4) has also stated that the fungus isolated from the mycorhizae of *Ericaceae* is capable of assimilating free nitrogen. The importance of these results, which appeared to

(1) JANSE, I. M. — Les endophytes radicaux de quelques plantes javanaises (*Ann. du Jardin de Buitenzorg*, Vol. XIV, 1897).

MAGNUS, W. — Studien an der endotrophen Mycorrhyze von *Neottia nidus-avis* L. (*Jahrb. f. wiss. Bot.*, 35, 1900).

SHIBATA, H. — Cytologische Studien über die endotrophen Mycorrhyzen (*Jahrb. f. wiss. Bot.*, 37, 1902).

PETRI, L., in *Nuovo Giorn. Bot. Ital.*, 1903.

GALLAUD, J. — Etudes sur les mycorhizes endotrophes (*Rev. Génér. de Botanique*, Vol. VI, 1908).

BERNARD, N. — L'évolution dans la symbiose. Les orchidées et leurs champignons commensaux (*Ann. de Sc. Natur.*, Série 9, 1909).

BURGHEFF, H. — Die Wurzelpilze der Orchideen. Jena, G. Fischer, 1909.

(2) HILTNER and NOBBE. — Über das Stickstoffsammlungsvermögen der Erlen und *Elea*gnaceae (*Naturw. Zeitschr. f. Land- und Forstw.*, II, 1904).

(3) NOBBE and HILTNER. — Die endotrophe Mycorrhyza von *Podocarpus* und ihre physiologische Bedeutung (*Landw. Versuchsstat.*, 51, 1898).

(4) TERNETZ, CH. — Assimilation des atmosphärischen Stickstoffs durch einen torfbewohnenden Pilz (*Ber. d. deutsch Bot. Ges.*, 22, 1904).

establish finally the great utility of endoradical fungoid symbiosis for the higher plants, has been considerably diminished by later researches: SPRATT (1) has shown that the root tubercles of *Podocarpus* contain nitrogen-fixing bacteria in addition to the symbiotic fungus, the presence of these being disregarded by Nobbe and Hiltner in their experiments. In the same way, the fixing of atmospheric nitrogen recorded by TERNETZ as occurring in the isolated mycelium of the mycorhizae of the *Ericaceae* has but a very relative value, since it is very doubtful if this fungus is actually the one which enters into symbiosis with these plants. As regards the fixing of nitrogen in the mycorhizae of *Alnus* and of the *Eleagnaceae*, the results of Hiltner and Nobbe's experiments have not yet been confirmed. The results obtained by SPRATT as to nitrogen assimilation by *Pseudomonas radicicola* do not, so far, lead to any definite conclusion, for it has not yet been demonstrated that this bacterium is the symbiotic micro-organism of these mycorhizae.

MÜLLER (2), in collaboration with RAMANN, has carried out a series of experiments in order to determine whether the heterotrophic mycorhizae of *Pinus montana* are capable of fixing atmospheric nitrogen, as stated by MÜLLER (3). The results of these researches have been entirely subversive of Müller's views. BURGHEFF also found that the symbiotic fungi of the roots of orchids can only live in substrata cotaining combined nitrogen. It thus appears unlikely, at the present stage of our knowledge, that the greater number of the mycelia giving rise to endotrophic mycorhizae, should be capable of utilising atmospheric nitrogen for the manufacture of their own albuminoid substances.

In another series of researches an attempt was made to discover the origin of this nitrogen in the organic matter and ammoniacal salts of the humus, which would be absorbed by the hyphae connecting the endoradical mycelium with the soil, or even by the root itself, the absorptive capacity of which would be modified by the presence of the fungus. FRANK, MAGNUS and CZAPEK share this view and consider that nitrogenous humus compounds of high molecular weight can be absorbed by the fungus and transmitted, in assimilable form, by it to the root cells. According to STAHL and his school, the essential part played by endotrophic and ectotrophic mycorhizae alike, is the taking up of nutritive salts; the possible assimilation of the nitrogen present in the air or in the humus, would therefore be a question of secondary importance. In the same way, according to BURGHEFF, the roots of *Orchideae* absorb by preference nitrogenous salts, especially ammoniacal salts. This writer considers that moors (*Hochmoore*), in which solublé nitrogenous compounds are wanting, would offer a suitable substratum to *Orchideae* provided their mycorhizae could insure to them

(1) SPRATT, E. R. — The Formation and Physiological Significance of Root Nodules in the *Podocarpineae* (*Ann. of Bot.*, 27, 1912).

(2) *Loc. cit.*

(3) MÜLLER, P. E. — Fichter und Bergkiefer auf gutlandischen Heidemooren (*Naturw. Zeitschr. f. Land- und Forstw.*, I, 1903).

the utilisation of this source of nitrogen (1). On the other hand, sandy soils, poor in nitrogenous compounds, are not suitable to *Orchideae*; this would not be the case if the mycelium of the mycorhizae were capable of insuring the fixation of atmospheric nitrogen.

Although WEYLAND, too, is a partisan of the theory of the " struggle for nutritive salts ", he admits the probability of the organic nitrogen of the humus being used by the endoradical mycelium.

This writer regards urea, which he finds in all forcedly mycotrophic plants, and usually in facultative ones also, as a product of the oxidation of the albuminoid substances elaborated by the fungus at the expense of the organic nitrogen of the humus. The advantage of the symbiosis for the host plant would reside in a gain in nitrogen, and in the utilisation, during the course of the respiratory processes, of the nitrogen-free residues derived from the splitting up of the urea.

As WEYLAND himself recognises, the presence of urea is not limited to mycotrophic plants; this compound is also found in some autotrophic plants growing in soils rich in humus (*Aspidium*, *Equisetum*), so that in the case of many humicolous and mycotrophic species it is impossible to state *a priori* that the urea is derived always and solely from the symbiotic fungus. It is, however, very probable; it remains only to be remarked that urea as a product of the oxidation of the albuminoid substances of the hyphae present in the interior of the root cells may still continue to be formed, even if the fungus manufactures its nitrogenous substances entirely at the expense of the host plant.

In most endotrophic mycorhizae, the hyphae forming the communication between the mycelium and the soil are very few in number, and this fact constitutes no slight obstacle to the application of STAHL'S theory to this form of symbiosis. In fact, if these hyphae have proved to be useless to *Neottia nidus-avis*, which is a saprophyte and thus obliged to obtain all its nutriment from the soil, no great value can be attached to them in the case of other mycotrophic plants.

BERNARD (2) has endeavoured by means of an ingenious theory to remove the difficulties arising when an attempt is made to explain the usefulness of endotrophic mycorhizae by the absorptive action of the mycelium. He admits that the plant receives no direct advantage from the presence of the symbiotic fungus, but considers that the activity of the latter stimulates the cortical tissues, and that this gives rise to a concentration of the cell sap which results in a greater development of root hairs and in more intense absorption. Absence of nitrates is recorded, both in endotrophic and ectotrophic mycorhizae. It is interesting to note in this connection, that in the case of facultative mycotrophic plants, even when these latter are grown in soils containing nitrates, the autotrophic rootlets alone give the

(1) WEYLAND (*loc. cit.*) attributes to the high degree of acidity possessed by some humous soils a fatal action upon the symbiotic fungus of *Orchideae*, which would explain the absence of these plants in such soils.

(2) BERNARD, *loc. cit.*

characteristic nitrate reaction. The endotrophic mycorhizae of these plants always give rise to a larger or smaller quantity of absorbent hairs; it is therefore very probable that the nitrates are absorbed by these hairs along with the other nutritive salts. The absence of nitrates in the mycorhiza tissues could be explained by supposing that the endoradical mycelium makes use of them immediately for the formation of albuminoid compounds. This is not so improbable as might be supposed, since it has been shown that some fungi can assimilate nitrates (1) by means of a process of reduction.

WEYLAND has also tried to demonstrate the absorption of phosphorus and potassium by the fungus. He succeeded, by suitable microchemical reactions, in locating these elements of the ash in the intracellular hyphae. Whereas, in the case of autotrophic roots the phosphorus is almost always found in inorganic combination, in the mycorhizae, thanks to the activity of the fungus, it quickly enters into organic combination. Nevertheless, it has not yet been proved experimentally that this accumulation of phosphorus and potassium is due to direct absorption by the hyphae which put the fungus in communication with the soil. The same rapid utilisation by the mycelium of the products of the autotrophic nutrition of the host, to which we referred above, may also be admitted in the case of phosphorus and potassium. The endophytic mycelium would be concerned in intercepting and accumulating the nutritive substances absorbed by the root-hairs from the soil. The injury to the higher plant, therefore, would only be relative, since the greater part of these substances would be reabsorbed. Similarly, the carbohydrates, the origin of which is certainly known to be endoradical, are reabsorbed. However, the substances accumulated by the symbiotic fungus are not all transmitted to the plant. During the transition from their primary to their secondary form the mycotrophic rootlets leave in the ground a certain portion of the cortex in which the digestion of the fungus has not yet taken place in all the cells which harbour it. This fact, however, is of considerable importance from the point of view of enriching the soil with nitrogenous organic matter. It is on these lines that the beneficial effect exercised by the heterotrophic mycorhizae of *Pinus montana* in sandy soils very poor in organic nitrogen can be explained, while spruce cannot grow until the soil has been enriched by the remains of these mycorhizae.

In the case of endotrophic mycorhizae also, some writers have allowed, a parasitic action of the endophytic fungus upon its host-plant. FLETCHER (2) appears to have recorded that in *Orchideae*, the symbiotic mycelium may actually behave as a parasite when inoculated into plants which are too young. But such a result is contrary to what we now know as to the behaviour of the symbiotic fungus towards the embryo and germinating seedlings of *Orchideae*. As has already been mentioned in dealing with ectotrophic mycorhizae, there is at present rather a tendency, also

(1) Cf. RITTER, E. — Ammoniak und Nitrate als Stickstoffquelle für Schimmelpilze (*Ber. d. Deutschen Bot. Ges.*, XXIX, 1911, p. 570).

(2) FLETCHER, in *Bull. de l'Inst. Pasteur*, 1909. Cf. also: NADSON, in *Centrbl. f. Bakt.*, II 26, 1910, p. 100.

in the case of endotrophic mycorhizae, only to admit of a possible indirectly injurious effect resulting where the conditions of the host-plant have become abnormal. On cultivated trees bearing mycorhizae, these fungoid growths often become extraordinarily numerous when, from lack of nutritive salts, or more frequently, on account of prolonged drought, the development of the rootlets becomes extremely slow (1). The insufficiency, or entire absence, of autotrophic rootlets in these conditions, in facultative mycotrophic plants, renders more perceptible the difficulties caused by want of adequate mineral nutrition or by scarcity of water.

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It is thus very difficult to draw a single definite conclusion from the results of the numerous researches (of which the most important have been mentioned in this article) that have been carried out with a view to explaining the physiological significance of the mycorhizae of trees.

A primary fundamental idea to which it is possible to attain is that all trees are facultative mycotrophic plants; symbiosis between their roots and mycelia is not therefore a biological necessity for them. It has further been proved that the fungi capable of causing the formation of ectotrophic mycorhizae on the same plant may be of different species; this shows that the tree does not select its root symbionts, but that the association is entirely fortuituous. As for the advantages which could accrue to the plant from the symbiosis, no one has ascertained whether they exist and in what they consist.

Apparently, however, we are justified in saying so far as ectotrophic mycorhizae are concerned, that their action enables the tree to make use of the nitrogenous compounds of humus, whereas in the absence of mycorhizae, in humous soils, the salts of ammonia are the only source of nitrogen. It still remains to be shown whether we must attribute to the high osmotic power of the symbiotic mycelium the by no means negligible rôle of compensating for the often considerable reduction in the root-hairs due to the fungoid infection, as well as for the originally weak absorption.

With regard to the utility of endotrophic mycorhizae, the theory attributing to their action a gain in nitrogen through the fixation of the nitrogen of the atmosphere would appear untenable, except for the mycorhizae of *Alnus* and of the *Eleagnaceae*; on the other hand, no experiment has proved that use is made of the organic nitrogen of the soil. The origin of the nitrogenous substances of the endoradical mycelium, of which the host-plant is said to make use by a process of digestion, remains completely unknown.

There is nothing to prevent our supposing that we are here dealing with a substance which the mycelium, during its intracellular growth, first ab-

(1) PETRI, L. — Studi sulle malattie dell'olivo (*Mem. d. R. Staz. di Patol. veg.* Roma, G. Bertero, 1911).

stracts from the plant, and then restores to its host during the last phase of its endoradical life. Such withdrawal and restitution of nitrogenous substances could hardly be of advantage to the host-plant. The same doubt may arise as to the acquisition of mineral salts, in view of the small number of hyphae capable of acting as absorbing organs. The action which the mycelium would exercise indirectly either upon the substratum by means of its enzyme secretions, or by modifying the normal activity of the secretion and absorption of the roots, still remains a matter of speculation.

In the final analysis we could therefore regard the endotrophic mycorhizae of trees as organs which intercept and accumulate nutritive substances, of which a part only would again enter into circulation in the host-plant, while the rest would serve to increase, perhaps sometimes to considerable advantage, the organic substances contained in the soil.

Thus understood, the connection between root and mycelium is only a case of simple commensalism, and is relatively harmless, as long as autotrophic nutrition is capable of affording compensation.

An interpretation of this association in the sense of a mutual symbiosis, while probable in certain cases, is entirely hypothetical at the present stage of our knowledge, for both forms of mycorhiza, at least as far as arborescent plants are concerned. The method of infection of the rootlets, the formation of intracellular or endocellular haustoria with a very extensive absorbent surface, the evident gain in carbohydrates, and perhaps also in nitrogenous substances, effected by the fungus in the course of its ecto- and endoradical existence, are so many proofs of its parasitic nature.

But the sum of our knowledge of mycorhizae entitles us to regard this parasitism as similar to that prevailing in numerous organisms, both plants and animals, where by a sort of refinement of the property of the parasite, the host is no longer killed but its nutritive activity merely stimulated in order to render its exploitation easier and more lasting.

Of such are, in general, the organisms producing galls, and mycorhizae behave in like manner. And, although in most cases, no one has thought of regarding the many gall hyperplasts known in nature, as cases of mutual symbiosis, this hypothesis has been adduced in the case of the mycorhizae of trees on account of their frequency and general distribution, and because it is here a question of a more or less profound change in an organ of the highest importance to the nutrition of the plant, *viz.* the absorbent portion of its root.

However justifiable the theory of mutuality may appear, the results of thirty years of scientific research, at least so far as arborescent plants are concerned, have led neither to its confirmation nor yet to its definite rejection.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

BIBLIOGRAPHY AND PRESS.

879 – **The Agricultural Press in Russia.** — *Département d'Agriculture: Industrie Agricole en Russie*, pp. 229-232 (in Russian and French). Petrograd, 1914.

The total number of periodicals published in the Russian Empire dealing wholly or largely with agriculture and rural sociology amounted to 352 in the autumn of 1914. Their distribution according to subjects was as follows:

	Number	Percentage of total
General agriculture and rural sociology	135	38
Branches of agriculture, including:		
Experimentation, soils, meteorology	25	
Live stock	19	
Beekeeping	19	
Horticulture, fruit, etc.	17	
Control of injurious animals and insects	5	
Agricultural engineering	2	
Industrial crops	7	
Permanent improvements	8	
	— 102	29
Veterinary science, forestry, cooperation, fisheries, home industries, etc.	83	24
Only partially agricultural	32	9

Arranging these periodicals according to their proprietors, we have the following data:

	Number of periodicals	Percentage of total
Agricultural societies and other social bodies	169	48.0
Private persons or private institutions	92	26.1
Zemstvos	54	15.4
State institutions	37	10.5

880 – **The Agricultural Resources of Afghanistan.** — *Journal of the Royal Society of Arts*, Vol. LXIII, No. 3253, pp. 440-441. London, March 26, 1915.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

Although a great part of Afghanistan is mountainous or too dry and rocky for successful cultivation, yet there are many fertile plains and valleys which with the occasional assistance of irrigation, yield very satisfactory crops of fruit, vegetables and cereals. The fruit industry is, next to sheep breeding, the source of greatest wealth to the country. A rapidly growing export trade in fresh and dried fruits exists with India. The dried fruits and nuts mostly go through the Khyber Pass, the fresh fruit through Baluchistan. The value of the former in 1911-12 amounted to £95 000, the latter during 1912-13 to £129 000. The most famous Afghanistan fruits include a sweet melon known as "sarda" which keeps good for four or five months, seedless grapes, fresh and dried, pistachio nuts and almonds. Fruit farming is divided between orchard fruit usually combined with vegetable farming and those fruits grown in fields on a large scale.

In the one class are apples, pears, almonds, peaches, apricots, plums, cherries, grapes, figs, quinces, pomegranates and mulberries, besides walnuts, pistachio nuts, edible pine and rhubarb. The fruit fields also produce several varieties of melons, cucumbers and pumpkins. There are two cereal harvests, one, reaped in summer, is sown in autumn and consists of wheat, barley and some pulse, the other, gathered in autumn, from a spring sowing, includes rice, maize, millet etc. Besides these, madder, tobacco, cotton, hemp, clover and lucerne are cultivated. Among a few large landowners improved agricultural implements and pumps for irrigation are used. The cultivation of turmeric and ginger is important as well as horse breeding. Silk is produced in large quantities at Kandahar but its quality is capable of much improvement.

881 – **The Effect of Temperature on the Life Cycle of *Musca domestica* and *Culex pipiens*.** — KRAMER, S. D. (American Museum of Natural History) in *Science*, Vol. XLI, N, 1067, pp. 874-877. Philadelphia, June 11, 1915.

RURAL HYGIENE

There being a scarcity of data illustrating the relation of temperature to the rate of breeding of flies and mosquitoes, the author undertook a series of experiments extending from the end of July to the middle of September 1914; these were carried out in incubators the atmosphere of which was kept highly saturated, light being either diffused or absent. The results were as follows:

Average Duration, in days, of each biological stage at different temperatures.

	Temperature	Egg Stage	Larva	Pupa	Total
Musca domestica . . .	20° C.	1,2	13.3	8 8	22.3
	30° »	1	5.1	4.2	10.3
	35° »	1	4.3	4.0	9.3
Culex pipiens	20° C.	2	14	3.6	19.6
	Room temperature *	1	7.7	3.0	11.7
	30° C.	1	4.8	2.0	7.8

* between 20° and 30° C.

882 – **Destruction of Fly Maggots by the use of Shale Oil and Residual Oil of Tar with Resinate of Soda.** — BORDAS F., in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 24 (June 14, 1915), pp. 779-780. Paris, 1915.

Destruction of the Brachycerous Diptera, and in particular the members of the genus *Musca*, is best directed against their larvae; as these occur in more or less large masses, their destruction at this stage is the more easy.

In 1905, the writer had the opportunity, in conjunction with Prof. D'ARSONVAL, of controlling the experiments carried out in a large number of places as to the value of shale oil for killing flies. The results obtained, both in France and abroad, were most encouraging.

M. ROUBAUD proposed (*Comptes-rendus* Vol. 160, 1915, p. 690) the use of coal tar, either alone or mixed with ferric sulphate. The writer observes that heavy tar oils do not succeed in a liquid medium (cess-pools); being heavier than water, the oil quickly sinks to the bottom and no longer acts, whilst shale oils are lighter and remain on the surface, asphyxiating the larvae present and at the same time by their special odour keeping off egg-laying flies from the drain-pipes or ventilators of cess-pools.

If heavy coal-tar oils are sprinkled too liberally over manure heaps, they often injure its quality; the same may be said of 5 per cent cresyl, proposed in 1905 by DEMORA for the destruction of flies. These objections disappear if care is taken to use residual tar oils, that is to say oils freed from naphthaline and phenol. This oil in 2 ½ per cent water emulsion with the addition of resinate of soda, forms a stable emulsion that allows of a thin but sufficiently efficacious layer of oil being spread over very large surfaces of decomposing matter. The special odour of this oil drives away all Brachycerous Diptera, and its deodorising property is such that the unpleasant smells generated by putrefying substances can be lessened to a very great extent.

The emulsion can be applied by means of sprayers similar to those used in agriculture, or better, by machines working by the pressure of liquid carbonic acid.

883 – **Creation of a Central Station of Agricultural Chemistry and Reorganization of the Botanical Garden in Brazil.** — I. *Diario Official, Estados Unidos do Brazil*, Year LIV, Nos. 34 and 37. Rio de Janeiro, February 9 and 12, 1915. — II. *Bulletin Officiel du Bureau de Renseignements du Brésil à Paris*, No. 33, pp. 10-11. Paris, June 16, 1915.

CREATION OF A CENTRAL STATION OF AGRICULTURAL CHEMISTRY. Decree No. 11477, under date February 5, 1915 (*Diario Official*, February 9, 1915).

The Central Station of Agricultural Chemistry is instituted for the purpose of promoting the defence and development of agriculture and stock-breeding and also of the trade and industries connected with them. This Station will include a laboratory, an experiment field, a library and a permanent exhibition of objects connected with its special branch. The work of the Central Station of Agricultural Chemistry is as follows:

1) To examine and analyse, at the request of the different Services of the Ministry, or of institutions or interested persons: soils, waters, manures, plants, seeds, foods, forages, insecticides and all other products of agriculture, stock-breeding and allied industries.

2. To make cultural and manurial tests necessary for the general knowledge and economic application of the substances examined. These trials will be made in the experiment field attached to the Station, or on other ground given for the purpose by private individuals.

3. To give certificates guaranteeing the quality of the substances analysed that bear a registered or known mark, and to carry out systematically the necessary verifications.

4. To regularise the ways of taking samples and render uniform the examination methods, making them simple and rapid, by attentively following the researches and discoveries made in similar establishments in the most advanced countries.

5. To give technical advice to farmers, breeders, manufacturers and merchants.

6. To collaborate with the similar establishments in the country, at their request, in all matters likely to promote experiments and studies relating to agricultural chemistry.

7. To carry out scientific and technical experiments of general importance to agriculture, breeding and the allied industries.

8. To publish the results of its studies and experiments in a bulletin or in separate pamphlets.

9. To institute a practical course of instruction for persons wishing to specialise in the technique of agricultural chemistry.

For physiological and microscopical determinations (germination capacity, adulteration of seeds), the Station of Agricultural Chemistry shall be able to have recourse to the Laboratory for Plant Physiology and Seed-testing belonging to the Botanical Garden.

REORGANISATION OF THE BOTANICAL GARDEN. Decree No. 11484 under date February 10, 1915 (*Diario Official*, February 12, 1915).

The Botanical Garden is an establishment intended to promote the systematic and experimental study of botany, and especially of the Brazilian flora and its agricultural application. It contains private studies and laboratories, a library, a museum and collections of living and dried plants. The Direction of the Botanical Garden is expected to keep itself constantly informed of the researches carried out in similar establishments abroad.

AGRICULTURAL INSTITUTIONS.

884 - **Decrees and Regulations Dealing with the Reorganisation of the Agricultural Services in Brazil.** — I. *Diario official, Estados Unidos do Brazil,* Year LIV, Nos. 14, 29, 59, 61 and 68. Rio de Janeiro, January 16, February 3, 12, 14 and March 23, 1915. II. *Bulletin Officiel du Bureau de Renseignements du Brésil à Paris,* No. 33, pp. 3-19. Paris, June 15, 1915.

During the first three months of 1915 the Government of Brazil promulgated various decrees and regulations introducing changes into the Services dealing with agriculture and the industries connected with it. The following are directly concerned with agriculture (1).

I. — New Regulation of the Ministry of Agriculture, Industry and Commerce. — Decree No. 11436, of January 13, 1915. (*Diario official,* January 16, 1915).

The duties and functions of the Ministry of Agriculture, Industry and Commerce (« Secretaria de Estado dos Negocios da Agricultura, Industria e Commercio ») were determined by law No. 1606, under date of December 29, 1906.

The last law dealing with the budget having changed certain Services of this Ministry, it was necessary to make a new distribution of work among the Staff and in consequence to draw up a new regulation. The Ministry now comprises: 1) the Minister's Office; 2) the General Direction of Agriculture; 3) the General Direction of Industry and Commerce; 4) the General Direction of Book-keeping.

The General Direction of Agriculture is divided into two sections with the following functions:

First section:

I. Theoretical and practical teaching of agriculture and rural industries.
II. Agricultural inspection and defence.
III. Colonisation and hostels for immigrants.
IV. Protection of the Indians and installation of native workers.
V. The National Museum, botanic gardens, distribution of plants and seeds, general and special agriculture, sylviculture.
VI. Astronomy and meteorology.
VII. Rural building construction, agricultural hydraulics (irrigation and drainage).
VIII. Rural economics and agricultural statistics.
IX. Rural legislation, scientific studies undertaken for the promotion of agricultural progress, syndicates and co-operatives, provident societies, mutual agricultural associations, congresses, conferences, competitions, and agricultural commitees. Agricultural societies, banks, societies of agricultural credit and companies for agricultural exploitation.
X. Propaganda of all subjects of importance to agriculture at home and abroad.
XI. The use of refrigeration in agriculture and rural industries.
XII. Carriage roads; expenses of transport, making-up, packing, insurance, freights and tariffs.
XIII. Application of electricity to agriculture and rural industries.
XIV. Inspection of forests; forests of the federal domain and of the maritime districts.
XV. Agricultural and sylvicultural museum, sericulture and aquiculture.
XVI. Nominations, promotions, dismissal of the Staff.

(1) See also *B.* Aug. 1915, Nos. 779 and 833; also No. 883 above. (*Ed.*).

Second section ;

I. Breeding industry : courses in veterinary science, stock-breeding and dairying ; live-stock stations, importation of breeding animals ; studies relating to the breeding of domestic animals and the improvement of breeds, the instruction of breeders in the best breeding methods that can be adopted in Brazil ; hygiene of domestic animals ; studies on cattle feeding ; growth and analyses of forages.

II. Veterinary Service : exportation and transport of stock.

III. Live stock shows, exhibitions, fairs, congresses, conferences, societies, syndicates, co-operative societies, and provident and mutual associations relating to breeding and the dairy industry.

IV. Register of farmers, breeders and persons engaged in connected industries ; pedigree register of the animals and service of the register and of the general archives of brands and animals.

II. — The Service of Practical Agriculture. Reorganisation of the Service of Agricultural Inspection and Defence. Decree No. 11519, under date March 10, 1915 (*Diario Official*, March 14, 1915).

The decree determining the regulation of the new Service of Practical Agriculture (formerly of Agricultural Inspection and Defence) defines the aims of this Service as follows :

1. Encouraging the development of agriculture by the propagation of the most perfected methods of cultivation best suited to the country, and by putting these methods into practice on the properties of agriculturists.

2. Improving the existing crops by seed selection and by new methods of cultivation instructing as many farmers as possible in them.

3. Bringing about the adoption of new crops likely to contribute to the economic development of the country.

4. Making known the best methods of preparing and preserving the crops most suitable to the different markets and to the climate of Brazil.

5. Popularising the use of agricultural implements intended for the preparation of the soil, for sowing, for the treatment of crops and their produce, tree-pruning, grafting, etc.

6. Training the largest possible number of animals for ploughing and agricultural work.

7. Practically studying the rotations most suited to Brazil.

8. Encouraging agricultural co-operatives and syndicates, spreading the development of the spirit of association amongst the rural population.

9. Favouring the organisation of agricultural societies, of agricultural congresses and committees, fairs and regional exhibitions.

10. Drawing up and distributing popular publications of a practical character dealing directly with Brazilian agriculture.

11. Installing depôts for agricultural machines, implements and utensils, to be placed at the disposal of farmers.

12. Testing agricultural machines, insecticides, methods of destroying plant parasites with the object of being able to give useful information to farmers.

13. Collecting mineral, plant and animal specimens from the different zones of the country, organising exhibitions of these products and at the same time collecting all the information regarding them that is useful from a technical, economic and commercial point of view.

14. Sending to the Central Station of Agricultural Chemistry samples of soil, plants, fruits and plant and mineral products forwarded by the inspectors for analysis.

15. Collecting data respecting the local agricultural and economic conditions.

16. Furnishing gratuitously to farmers useful seeds and plants, Brazilian or foreign, capable of serving as a basis of industrial crops.

17. Having recourse to the most efficacious methods of propaganda for the preservation of forests, the planting of forest trees and the spread of the most perfected methods of exploiting forest products.

18. Inspecting agricultural property given to the Government, or acquired by it.

19. Undertaking the agricultural defence of the country against animals or plants injurious to imported plants and seeds as well as to those of Brazilian origin.

20. Founding agricultural institutions charged with the production of selected seeds and plants for gratuitous distribution to growers. These institutions shall also carry out experiments, in order to obtain more productive plantations than those at present existing, as well as plantations that are more resistant to injurious agents and possessed of better means of natural defence, so that each cultivated plant shall be transformed into a potent instrument for the protection of Brazilian agriculture.

21. Making known to farmers the best methods of rural hygiene that they can apply with the means at their disposal in the districts they inhabit.

22. Collecting all the data necessary for the determination of the yield per hectare of Brazilian plantations, the expenses and receipts of the agricultural estates, the growers' profits and the commercial value of each product.

23. Distributing large quantities of the seeds of the best pasture grasses which can promote most quickly and economically the increase and improvement of stock-breeding and especially the breeding of cattle and horses.

24. Installing stores of agricultural machines and implements in order to facilitate their purchase by farmers at cost price plus the expenses of transport and insurance.

25. Publishing notes on the areas to be sown in the case of each crop grown on a large scale, giving the condition of the crop and a forecast of the harvests.

The Direction of the Practical Agricultural Service is divided into two sections, the one technical and the other administrative.

For the carrying out of the above programme in the States, the territory of Brazil is divided into fourteeen districts, in each of which an Agricultural Inspection shall be established, viz. :

1st district) Amazonas, with centre at Manaos; 2nd) Pará and Maranhão, with centre at S. Luiz ; 3rd) Piauhy and Ceará, with centre at Fortaleza; 4th) Rio Grande do Norte and Parahyba, with centre at Natal; 5th) Pernambuco, with centre at Recife; 6th) Alagôas and Sergipe with centre at Maceio; 7th) Bahia, with centre at Bahia; 8th) Espirito Santo and Rio de Janeiro with centre at Campos; 9th) São Paulo, with centre at São Paulo; 10th) Paraná and Santa Catharina, with centre at Curytiba; 11th) Rio Grande do Sul, with centre at Porto Alegre; 12th) Minas Geraes, with centre at Bello Horizonte; 13th) Goyaz, with centre at Goyaz; 14th) Matto Grosso, with centre al Cuyabá.

Each Agricultural Inspectorate is directed by an Agricultural Inspector assisted by « Agricultural Instructors », who are charged with giving practical instruction to farmers and all the information necessary for the improvement of cultural methods. In each region, five or six properties are to be selected, on which, with the consent of the owners, the Agricultural Instructors shall prepare an area of about five acres where they will plant and cultivate the crop chiefly grown in the district, in order to demonstrate practically the advantages of new methods. The Agricultural Instructors shall also visit the farms of the region and give practical advice to the farmers; they shall be accompanied by technical experts to explain

the handling of the agricultural machines. Finally the Agricultural Inspectors are to place their services at the disposal of primary school teachers and to give practical lessons to the pupils.

Demonstration fields shall be laid out, with the object of showing to farmers, on the actual site of their labours, the improvements that can be made in the crops of the country. In these demonstration fields an attempt shall be made to improve the principal crops of each State, the harvest can be distributed gratis, as selected seed, to agriculturists ; young fruit trees of the best kinds shall be distributed in the same manner. The demonstration fields must have an area of at least 120 acres, the soil being good and healthy and provided with drinking water, running water by preference ; they must always be situated in the neighbourhood of important agricultural centres, so as to be easily visited by persons interested in the work and by pupils and students. The work of the demonstration fields shall be done by ten "agricultural apprentices", 15 years old or more, who shall receive the same wages as the agricultural workers of the region and at the end of a year shall be granted a preliminary certificate in the institution. These apprentices shall be given practical information respecting rural hygiene in addition to their professional instruction.

Finally, the most minute precautions are to be taken in the distribution of seeds ; these must be healthy and in a good condition of germination, and their entrance and despatch are to be registered in a special book, together with all necessary details.

The Federal Government shall forbid the entrance into the ports of Brazil and the transit between the States and Municipalities, of living or dried plants, grafts, nursery trees, flowers, leaves, seeds, fruits, tubers, soils, manures and in general, of all objects by which injurious animals, larvae, or parasites might be introduced into the country.

The wrappers or packing material of imported plants and seeds, as well as of those sent from one part of Brazil to another, must bear the names and adresses of the sender and the importer, together with the place and establishment whence they have been despatched.

Imported plants and seeds must be accompanied by a certificate granted by the competent authority in the country from which they are sent and certifying that they are free from all disease. The acceptance of such plants and seeds is always subject to an examination of their condition and plants attacked by contagious or infectious diseases shall be destroyed, or re-exported, according to the wish of the consignee.

III. — Reorganisation of the Intelligence Service. Decree No. 11509, under date March 4, 1915 (*Diario Official*, March 12, 1915).

The new regulations of the Intelligence Service (« Serviço de Informações », formerly « Serviço de Informações et de Divulgação) thus define the aims of this Service :

1) To give to all the agricultural, industrial and commercial classes of Brazil information and intelligence regarding the subjects interesting each of them respectively.

2) To study the most favourable measures for the development of national production and of the economic relations of Brazil with other nations.

The duties and functions of the Intelligence Service are as follows:

1. To give information, either written, or printed in the form of books or pamphlets, whether demanded officially or requested by private persons, on all subjects connected with the economic development of the country.

2) To carry out gratuitously and systematically the distribution of books, pamphlets, photographs, maps, statistics and other means of information serving to promote the knowledge of Brazil in foreign countries and the instruction of the agricultural and industrial classes.

3. To publish in the press, in the form of short but complete communications, information respecting the conditions of agriculture, trade and industry in the States, forecasts of the crops, the stocks of merchandise, the market prices and condition of the markets, industrial inventions, the results of experiments and observations made in the establishments of the Ministry or abroad, and all other intelligence that may be useful to the development of national production.

4. To communicate every week to the press of Rio de Janeiro and of the capitals of the States a telegraphic summary of the market prices and the stocks of the chief articles.

5. To draw up by means of card-indexes a commercial and industrial catalogue of Brazil, including: names of firms and partners, nature of the social contract, object of the business, capital of the society, the head office or domicile of the firm. Copies of these cards shall be sent to the Commercial Executives and Associations of Brazil, the International Chamber of Commerce of Brazil, the Commercial Museum and other corporations and institutions which have collaborated in this work.

6. To draw up and publish periodically the Bulletin of the Ministry, which shall contain a statement of all the Acts of the Federal Government emanating from the Ministry of Agriculture, Industry and Commerce, the memoirs or original articles, translations, transcriptions, statistical data, notices and information dealing with agriculture, industry and commerce in Brazil and abroad, so as to form as complete a source of information as possible relating to cultivation, industry and commerce.

7. To collect and catalogue all the printed matter published by the Service or the Ministry, together with any books, pamphlets or other publications that shall have been acquired.

8. To prepare from the data already in its possession and from others to be collected, on all subjects connected with the Ministry, archives of information allowing of quick reply to all questions.

9. To study the condition of agriculture and national commerce, the nature of the Brazilian importation and exportation as regards the countries that send and receive the goods, and the conditions of new markets which might be open to Brazilian products.

10. To exchange the publications published by the Service or the Ministry for those of national or foreign institutions, Academies, and Associations, and for newspapers.

IV. — Reorganisation of the Service of Waters and Public Works. Decree No. 11515, under date of March 4, 1915 (*Diario Official*, March 23, 1915).

The Service of Waters and Public Works is charged with supplying and distributing water to the Federal Capital, the construction and upkeep of canals, the preservation of springs, forests, roads and tracks, the construction and keeping in repair of the rain-water drains of the Union in the Federal District, etc.

V. — Inspection of Works Against Drought. Decree No. 11474, under date of February 3, 1915 (*Diario Official*, February 23, 1915).

The inspection of works against drought is dependent on the Minis-

ry of Transport and Public Works. It is entrusted with all the services, schemes and works of which the object is the control of drought in the regions included between the State of Piauhy and the north of the State of Minas Geraes.

The schemes and works intended to hinder drought and lessen its effects are as follows:

1. Systematic study of the meteorological, geological, topographical and hydrological conditions throughout this immense zone of the territory of Brazil.

2. Continued and systematic observation of meteorological phenomena, especially of the laws governing rainfall, and the direct measurement of the most important rivers.

3. Preservation and reconstitution of forests; systematic trials of the crops most suitable to the special conditions obtaining in this region.

4. Railways and carriage roads for facilitating transport and communication between the zones affected, the centres of production and the markets of communication.

5. The sinking of tubular or artesian wells.

6. The study of small private reservoirs to whose multiplication the Union will contribute by paying, in the form of a premium, half the construction expenses incurred by the interested person.

7. The study and actual construction, at the expense of the Union, of public reservoirs for the purpose of preventing the complete disorganisation of work due to drought and of facilitating resistance to the effects of the latter.

8. Construction of weirs and other works for decreasing the destructive force of both streams and torrents.

9. Drainage of marshy valleys.

10. Works connected with fish-breeding, forestry gardens, etc.

The reservoirs are divided into three categories: *large*, *medium-sized* and *small*. Large reservoirs are defined as those with a capacity of over 350 million cubic feet and an outlet more than 33 ft. deep; the medium-sized reservoirs have a capacity exceeding 140 million cu. ft. and an outlet of at least 20 ft. in depth, while the small ones have a capacity of at least 17 million cu. ft. and an outlet not less than 13 ft. deep. The large reservoirs are to be constructed by the Union, which shall also be able to undertake the construction of such medium and small reservoirs as are urgently needed, especially those near roads or centres of population.

The Inspection of Works against Drought shall, at the request of municipalities, agriculturists or breeders, have wells sunk in places where water has beeen proved to exist in the subsoil; it shall also instal the necessary windmills, pumps and reservoirs.

The necessary workmen and material shall be placed at the disposal of agriculturists and breeders, who will only repay to the administration the expenses incurred. The neighbouring inhabitants shall be able to supply themselves with water from wells dug under these conditions.

Carriage roads shall be constructed between the points affected by drought and the markets and centres of production.

Barrages shall be constructed in the beds of watercourses to regulate torrential flows, store the water for irrigation and preserve moisture.

The drainage and drying-up of marshy valleys is to be carried out, as

well as the improvement of cultivated land in the interior, where fam lies of agriculturists will be settled.

The necessary rainfall stations and observatories shall be establishe by the Inspection and entrusted, as far as possible, to the post offic and telegraph employees.

The Inspection shall start and keep up forestry gardens for the pur poses of preserving and reconstituting the forests, distributing young tree and furnishing technical assistance. These gardens shall be situated, b preference, in the neighbourhood of large basins and perpetually flowin streams ensuring easy irrigation. They shall consist of nurseries for tree and indigenous or exotic plants capable of being transplanted; forag and industrial plants shall also be grown in them with the view of deter mining and distributing the most profitable species. Finally the practica and economic methods of irrigating and transplanting the species mos adapted for the development of forests in the arid regions shall be studied

Attention is to be given to the development of fishing in the reservoir and streams of the arid zone, where those species of fish known to be th best are to be introduced and the unsatisfactory kinds destroyed.

Premiums shall be granted to private persons, municipalities and agri cultural syndicates constructing medium or small reservoirs. These pre miums may amount to half the construction estimate, the latter havin being previously approved.

885 – **Appropriations for Agriculture in the United States.** — *The Country Gentlema* Vol. LXXX, No. 17, p. 775. Philadelphia, April 24, 1915.

The Agriculture Appropriations Bill for 1916 which was passed befor the third session of the sixty-third Congress adjourned, carried a total o $ 22 971 582.

The chief appropriations are : $ 235 000 for the Office of Farm Manage ment, which has become an adjunct to the Office of the Secretary instead o an appendage of the Bureau of Plant Industry as formerly. The new policy of the Department is to make agricultural economics one of th leading features of its work.

A special sum of $ 2 500 000 has been voted to provide an emergenc fund for controlling outbreaks of foot-and-mouth disease, rinderpest an other contagious diseases of animals. The sum of $ 235 000 has been mad available for the campaign against hog cholera and dourine of horses.

In conjunction with $ 438 000 for the eradication of cattle ticks in th South, the sum of $ 50 000 was allowed for livestock demonstration work i the areas freed from this parasite. For other experiments and demonstra tions in livestock production in the sugarcane and cotton districts $ 60 00 were appropriated. For farmer's cooperative demonstration work out side the Cotton Belt $ 386 080 were voted and the same character of wor for the South got $ 666 020.

A sum of $ 40 000 has been appropriated to enable the Departmen of Agriculture to assist settlers on the Government reclamation projec by demonstrations and advice.

886 – **Development of the Department of Agriculture of the Dutch East Indies during the First Ten Years of its Existence.** — *Tijdschrift voor Nijverheid en Landbouw in Nederlandsche-Indie*, Vol. XC, No. 3, pp. 163-182. Batavia, March 1915.

Since its establishment ten years ago, the work of the Department of Agriculture of the Dutch East Indies has trebled, for it has become the Department of Agriculture, Commerce and Industry. The development of the Department may be judged from the budget, which amounted to £578 000 in 1905 and to £1 054 000 in 1915. From January 1, 1911, the various institutes occupied with purely scientific research were united into a large section entitled "Botanic Garden". Other sections were also organised for industry and commerce, fisheries, diseases of plants, and crops, the Veterinary Service being also instituted.

After 1910, the Service of Agricultural Intelligence was developed; at present its staff includes 13 qualified agriculturists and other officers for special services. Agricultural instruction, which has made much progress, has already called into existence 11 native agricultural instructors and 20 native candidates. In 1905 the Veterinary Service was composed of 22 veterinaries; to-day it boasts of 44. The assistant staff has been increased from 10 to 179 clerks ("mantris"). The activity of the Industrial Section is shown in the foundation of schools of art and trade schools, and by the progress of apprenticeship to native industry. The Forest Service, which in 1905 consisted of only 3 inspectors and 43 rangers, now possesses 6 inspectors and 103 general forest rangers; the revenues rose from £145 655 in 1905 to almost £200 000 in 1913 (1).

887 – **Competitions in Standing Crops for the Production of Seed Grain in Quebec.** — *Report of the Judges of the Competitions* 1914, pp. 3-73. Ministry of Agriculture, Quebec, 1915.

AGRICULTURAL SHOWS AND CONGRESSES.

This is the report of the Seventh Competition in Standing Crops for the Production of Seed Grain held in Quebec since its inception in 1908.

The aim of these competitions is:

1) To induce farmers to gather choice seed grain.

2) To make special seed-beds besides the ordinary sowings, so as to provide good seeds for the following year, by using the best grain and seed, sown on lots kept very clean and prepared in the best manner and gathered separately.

3) To obtain pure seedings, unmixed with any other variety or species.

4) To encourage the use of the best yielding seeds.

5) To encourage the employement of clean and selected seedings, to obtain uniform and vigorous crops with healthy strong straw.

6) To develop careful cultivation free from weeds.

The interest shown by the farmers in these competitions continues to increase as shown by the following figures:

(1) See: Verslag omtrent Handel Nijverheid en Landbouw. *Publicaties van de Afdeeling, Nijverheid en Handel*, 1, 1914. (*Ed*).

Year	No. of Competitions	No. of Competitor
1908	18	171
1909	43	599
1910	45	591
1911	54	570
1912	61	782
1913	61	855
1914	67	1 023

Obviously these competitions have gone far towards the improvemer of the seed grain generally used in the province of Quebec. The repor of the judges of the various crops are of great value in pointing out th principal causes of failure, weakness or defects found in the fields of som of the competitors.

With regard to pure seed-grain, the farmers who grow their own seed grain and select it as best they can either on the field or by means of a sepa rator still continue to obtain the best results.

The campaign in favour of the production of pure clover and timoth grass seed has met with excellent results. Almost all the farmers now re alize that weeds are often introduced in purchased seed and are desirous o raising their own seed supply.

CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

888 -- **The Formation of Humic Bodies from Organic Substances.** — BOTTOMLE W. B. (King's College, London), in *The Biochemical Journal*, Vol. IX, No. 2, pp. 260-26 Cambridge, June 1915.

Soil humus is generally recognized as a substance of great complexity it has been investigated by isolating and examining various groups of i constituent compounds. Of these groups, the most important are *humi acid* which is soluble in water or alkalies and precipitated by acids, a *humin* which is insoluble in water and alkalies but rendered soluble b fusing with caustic soda or potash. Substances entirely similar to humi acid and humin can also be obtained by boiling sugar with sulphuric hydrochloric acid, and the present investigation was undertaken to stud the relationship between the natural and artificial products.

Samples of sucrose, dextrose and levulose were boiled with 3 per ce hydrochloric acid for periods of time varying from ¼ to 3 hours. T colour changes undergone by the liquid were noted and the final yields humic acid and humin were determined. The amount of total precipita formed varied with both the kind of sugar employed and the duration the treatment. In all cases, the first brown deposit was found to cons of humic acid without a trace of humin. On further boiling humin al was formed, and the longer the boiling was prolonged, the higher became t proportion of humin in the total precipitate. The formation of humi from humic acid was subsequently confirmed by boiling freshly preci

tated humic acid obtained from peat and from levulose with hydrochloric acid ; 3.5 per cent of the peat acid and 98 per cent of the levulose acid were converted into humin.

Previous investigators have shown that artificial humic acid produced from sugar and natural humic acid obtained from soil or peat, though almost identical in appearance and in their behaviour with alkalies, are rather different as regards their chemical composition, the artificial product having a higher carbon content than the natural one. This would indicate that the natural product does not consist of pure humic acid but of an admixture with other organic substances. To test the hypothesis, some humic acid from peat was boiled with absolute alcohol for an hour and the purified residue was analysed and proved to have the same chemical composition as a sample of humic acid prepared from dextrose.

Various organic acids, *viz.* lactic, acetic, propionic, butyric, citric, tartaric and oxalic, were boiled with sugar to determine whether these acids were capable of producing the same changes as mineral acids. All caused the formation of humic acid and humin, but the rapidity of the reaction varied with the kind and the concentration of the acid used.

By the simple application of heat to the sugar solutions, bodies very similar to humic acid and humin were obtained, but there was a considerable difference in the behaviour of dextrose and levulose in respect to the temperatures required to bring about the reactions.

Four proteins were selected, two of which were rich in carbohydrates (mucin and egg albumin) while the two others (caseinogen and purified egg albumin) were practically free from carbohydrates. These proteins were hydrolysed by boiling for eight hours with hydrochloric acid and the brownish black residues obtained were examined for humic acid. While the residues from the proteins rich in carbohydrates yielded 2 to 3.5 per cent of humic acid, the caseinogen and the purified egg albumin yielded practically none.

889 - **The Antizymotic Action of a Harmful Soil Constituent: Salicylic Aldehyde and Mannite.** — SKINNER, J. J. (U. S. Dep. of Agriculture, Bureau of Soils), in *The Plant World*, Vol. XVIII, No. 6, pp. 162-167. Baltimore, Md., June 1915.

In the course of an investigation on an old garden soil (Mount Vernon, Virginia) which gave signs of decreasing fertility, salicylic aldehyde and mannite were isolated. The former compound has since proved invariably toxic to vegetation under all experimental conditions and the present paper deals with the behaviour of mannite towards plant growth.

Mannite was present in the soil in amounts equal to about 500 lbs. per acre. Though this substance is readily produced by certain soil fungi, its presence in such large quantities was remarkable as it is a very unstable compound and an admirable medium for the growth of bacteria. Its effect on plant growth was tested in a series of water cultures. A first set was run using pure distilled water with and without the addition of various quantities of mannite (10 to 200 parts per million). Growth in the mannite solutions was about equal to that in pure distilled water. In the next set, 66 different culture solutions were employed, representing various conbinations

of monocalcium phosphate, sodium nitrate and potassium sulphate, of any two of these salts, or even the single salts. One series received in addition to the salts 100 parts per million of mannite, while the second series was used as a control. Wheat seedlings were grown for 12 days and the solutions were changed every third day and analysed for nitrates, nitrites and ammonia to determine if decomposition had taken place.

The total production of green weight was greater in the control solutions (157.2 gms.) than in the mannite solutions (142.4 gms.), but it was remarkable that whenever phosphates were absent from amongst the nutrient salts, the superiority of the control series disappeared, and in these cases no decomposition of nitrate occurred, though nitrites and ammonia were found in all the other mannite solutions. These results indicate that mannite, apart from the part it played as a medium for bacterial activity, had no deleterious effect on plants, for wherever phosphates were absent from the solutions and the latter were thereby rendered unsuitable for the development of organisms, the presence of mannite in no way inhibited the growth of the wheat plants.

In order to reproduce more exactly the conditions existing in the Mount Vernon soil and to determine the effect of mannite in presence of salicylic aldehyde, another set of water cultures were prepared in which various quantities of salicylic aldehyde were added to nutrient solutions containing mannite. One series of solutions were allowed to stand without plants, while in the other wheat seedlings were grown as before. Decomposition of nitrate occurred irrespective of the presence of the wheat plants whenever the doses of salicylic aldehyde were below 25-50 parts per million. In such concentrations the aldehyde was injurious to plants as well as to bacterial life.

The existence of mannite in the Mount Vernon soil is probably made possible by the simultaneous presence of salicylic aldehyde, for without any antiseptic action of this kind, mannite if formed would immediately be destroyed by soil organisms. As the result of these investigations, lime and phosphoric acid have been applied to the garden and its drainage has been made more effective. Marked improvement in fertility has thus been obtained.

890 – **Soil Organic Matter as a Culture Medium for *Azotobacter*.** — MOCKERIDGE, F. L. (King's College, London) in *The Biochemical Journal*, Vol. IX, No. 2, pp. 272-283. Cambridge, June 1915.

In order to discover how far *Azotobacter* is capable of utilizing the wide range of organic compounds which occur in soil, cultures of the organism were inoculated into series of media made up of various organic substances and mineral salts. The organic substances in question included humates, polysaccharides, sugars, alcohols, the calcium salts of organic acids, esters, glucosides and benzine derivatives.

In the case of the humates, growth was only obtained when the organic matter was supplied as ammonium humate and no nitrogen was fixed. The availability of the glucosides was restricted somewhat by the products of their decomposition and the benzine derivatives proved totally unable to

provide a source of energy for *Azotobacter*. The presence of either of these two latter classes of compounds, however, never inhibited growth on manitol-agar plates. The carbohydrates tested showed themselves in general to be readily available sources of food for *Azotobacter*. The returns of nitrogen fixed for the expenditure of food material varied considerably and the rule seemed to be that the longer the time taken to use completely a unit mass of the nutrient, the less nitrogen was fixed upon that medium.

Considering the wide range of compounds which *Azotobacter* proved itself capable of assimilating, it is evident that any ordinary soil must contain abundant food material for the growth of the organism.

891 – **Effect of Moisture Content of a Sandy Soil on its Nitrogen-Fixing Power.** — LIPMAN, C. B., and SHARP, L. T. (University of California), in *The Botanical Gazette*, Vol. LIX, No. 5, pp. 402-406. Chicago, Ill., May 1915.

The activity of nitrogen-fixing organims was determined under varying conditions of soil moisture. A light sandy soil was selected for the purpose; 50 gm. portions of air-dry soil were mixed with 1 gm. of mannite, and after adjusting their water content they were incubated for 21 days at 28° -30° C. The amounts of nitrogen fixed are given below:

Water content of soil on air-dry basis (hygroscopic moisture 2.5 per cent.)	Nitrogen fixed per gm. of mannite
per cent.	mgms.
0	0
4	0.88
8	3.68
12	5.95
16	5.95
20	8.05
24	8.05
28	7.18
32	4.55
36	2.98

The optimum water content of the soil as determined by physical tests was 20 per cent, and it was at this point too that nitrogen-fixation was most active.

892 – **The Effect of Copper, Zinc, Iron and Lead Salts on Ammonification and Nitrification in Soils.** — LIPMAN, C. B., and BURGESS, P. S., *University of California Publications in Agricultural Sciences*, Vol. I, No. 6, pp. 127-139. Berkeley, 1914.

In the course of an investigation on the value of smelter waste to agricultural crops, it became necessary to ascertain the action of various metallic salts on soil organisms. The available evidence in this connection being somewhat contradictory, a fresh series of experiments were carried out to determine the effect of the sulphates of copper, zinc, iron and lead on ammonification and nitrification processes.

To fifty-gram portions of dry soil, one gram of tankage (containing 7.62 per cent of nitrogen) was added, together with sufficient water to pro-

duce optimum conditions and the metallic salts to be tested. The soil wa then incubated for a week at 27° to 30° C., after which it was analysed fo ammonia. The results are given in Table I.

TABLE I. — *The effect of metallic sulphates on ammonification.*

Amount of salt added	NH_3 produced			
	$CuSo_4$	$ZnSo_4$	$FeSo_4$	$PbSo_4$
per cent of dry soil	mgms.	mgms.	mgms.	mgms.
0	39.90	39.90	39.90	39.90
0.005	39.41	36.75	38.64	38.22
0.010	36.40	38.29	38.43	37.65
0.025	35.35	36.40	37.24	40.74
0.050	36.12	32.97	38.15	39.56
0.075	31.70	31.71	37.31	39.34
0.100	28.98	30.10	38.78	35.77
0.125	28.21	31.50	35.28	35.21
0.150	29.33	33.52	36.54	33.88
0.200	27.05	34.09	36.75	33.95
0.250	28.14	32.48	37.10	35.63

TABLE II. — *The effect of metallic sulphates on nitrification.*

Amount of salt added	Nitrates produced			
	$CuSo_4$	$ZnSo_4$	$FeSo_4$	$PbSo_4$
per cent of dry soil	mgms.	mgms.	mgms.	mgms.
0	10.92	10.92	10.92	10.92
0.0125	9.24	10.92	15.40	6.30
0.0250	10.64	11.90	12.74	9.10
0.0500	18.20	16.80	13.58	10.64
0.0750	24.64	12.40	12.88	12.74
0.1000	22.22	23.10	8.12	7.06
0.1250	20.16	17.65	19.60	12.04
0.1500	20.16	17.22	20.16	6.58

The four salts proved toxic in all concentrations, the toxicity increa ing with the concentration of the salts and reaching a maximum with dos of about 0.1 per cent. In no case, however, did the salts show themselv very injurious, as even the most effective doses did not reduce bacteri

activity by more than 30 per cent. Copper and zinc were markedly more toxic than iron and lead.

In the nitrifying experiments, 100 gm. portions of soil were used to which two gms. of dried blood (containing 13.29 per cent of nitrogen) were added and the soils were incubated for four weeks. The results are given in Table II.

The results were rather more irregular than in the case of the ammonification tests, but all the salts produced distinct stimulating effects in some concentration, the formation of nitrates being in many cases doubled. In the copper and zinc series, the minimum doses either produced no stimulation or even had a toxic effect, while maximum nitrate formation was obtained with doses of about 0.1 per cent. The other two series were more erratic in their behaviour and lead sulphate was particularly toxic in small doses.

893 - **Elimination of Seepage from Embankments.** — SHERRILL, C. O., in *Engineering Record*, Vol. 71, No. 13, pp. 552-554. New York, May 1, 1915.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

Owing to the excessive seepage that occurred through the standard Mississippi River embankments during the great floods of 1912 and 1913, experimental work was undertaken with a view to determining whether seepage could not be prevented so as to keep the embankments dry during the high flood period, namely 30 to 40 days.

With this object a basin was constructed in the rear of the main embankment in the shape of a parallelogram, two sides of which were formed by 1276 feet of embankments of different sections and type. Thus one section was of full standard section, 8 foot crown with banquette and no additional protection; another length was standard section, slopes 1: 3, without banquette and with 4 inch concrete and 20 foot sheet-piling; a third length had a 5 ft. crown, slopes 1: 2, 2 inch "gunite" (a special concrete) and 20 foot wood interlocking sheet pile protection; and a fourth length had concrete and steel pile protection.

On the protected portions either ordinary concrete or gunite was placed and the latter was put on in different ways: *a*) directly on the slope, *b*) with a slight reinforcement, *c*) on gravel with reinforcement on the top, *d*) on gravel 2 inches thick and no reinforcement. This last proved the most satisfactory, and cost 33 per cent less than the 4 inch concrete.

Four sets of test wells, with four wells in each set, lined with terra cotta pipe, were driven in order to determine the rise and amount of rise of the plane of percolation through the embankment.

The basin was then pumped full and the seepage through the different sections was observed. The behaviour of the protected sections as compared with those unprotected shows the superiority of protected embankments of small section over the larger standard sections of earth alone. The main embankment began to seep shortly after the basin was filled, the concrete protected section seeped only at two small places, due perhaps to cracking of the concrete or subsidence, while the smaller section gunite and sheet pile protected bank showed no seepage, and the fields in the rear remained dry.

Tables have been compiled showing that for heights above 16 feet the smaller embankments with gunite and interlocking wood sheet-piling cost less than the large unprotected one. For heights up to 16 ft the reverse is the case.

MANURES AND MANURING

894 – **Experiments on the Application of Sulphate of Ammonia at Different Depths.** — MALPEAUX L., in *La Vie agricole et rurale*, Year 5, No. 4, pp. 61-65. Paris, June 5, 1915.

The soil chosen for these experiments was a uniform loam in good condition, which had been dug two spits deep. At the beginning of April the writer marked out six adjacent rectangular plots, which were then dressed as evenly as possible with sulphate of ammonia at the rate of 360 lbs. per acre dug in at varying depths from 2 to 12 inches.

A portion on the same side of each plot was reserved without crop and the whole of the remainder sown with sugar-beets. The thinning out was carefully done so as to leave the same number of plants in each plot. Samples of soil were taken to a depth of 16 in. simultaneously in both cultivated and bare ground on June 30, July 31, and August 29 and the percentage of nitric nitrogen was determined by the colorimetric method.

The detailed results of these analyses are summarised as follows :

On bare land the variations are of small extent in the control plots, which only yielded for determination nitrates resulting from the nitrification of humus in the soil. The maximum figures occur in the zone from 4 to 8 in. and from 8 to 12 in. The same result was also found in all plots where the manure was buried. Where sulphate of ammonia was applied as a top-dressing the greatest proportion of nitric nitrogen remained in the upper 4 in., a circumstance which is obviously unfavourable to its rational use by a tap-rooted plant like the beet. The results for the total amount of nitric nitrogen of each plot receiving nitrogenous manure agree sufficiently to show that in no case was there any loss of nitrate. Even where the sulphate of ammonia was not most deeply buried, the maximum amount of nitrate is found in the zone between 8 and 12 in. deep. Thus the combined influences of rain and capillarity cause the ascent of soluble manure towards the surface.

Since the manure did not leave the 16 in. layer, the variations in the total amount and proportions of nitric nitrogen for each plot of beets can only be due to the absorption by plants. Consequently the differences in the figures of corresponding plots in bare soil give a measure of the relative quantities of nitrogen consumed by the plants. Whilst the control plot was only able to supply 5 mgms. of nitric nitrogen per 100 mgs. of dry earth, the manure had provided 6.8 when applied as a top dressing, 7.7 when buried at a depth of 2 in., 9.5 at a depth of 4 in., 8.8 at 7 in., and 9.1 at 12 in. It is thus easy to see that the best use of the manure is obtained by burying to a depth of at least 4 in.

This conclusion is supported by the results of the weighing and analysis of the roots from each plot, as shown in the following table:

No. of plot.	Sulphate of ammonia applied at:	Yield, in cwt. per acre		Density at 15°C	Percentage of sugar in juice	Purity	Percentage of sugar in roots	Yield of sugar per acre
		Leaves	Roots					
								cwt.
1	Control	282	226	7.4	16.87	86.8	14.53	32
2	Surface	469	274	7.0	15.54	84.5	13.52	37
3	Depth of 2 inches	457	282	7.1	15.90	84.7	13.81	39
4	» » 4 »	465	389	7.4	16.23	82.8	14.07	55
5	» » 7 »	471	358	7.1	15.98	85.0	13.88	50
6	» » 12 »	477	356	7.2	16.55	86.9	14.36	51

The manure applied as a top-dressing or simply dug in to a depth of 2 inches was later in action than in the other plots. Growth was prolonged and there was a predominance of leaf development over that of the roots, especially in the autumn. The greatest yield was obtained with manures dug in to a depth of 4 inches, but the results of the plots dug to a depth of 7 and 12 inches were also very satisfactory.

895 – **The Use of Charcoal as a Medium for Plant Growth.** — APPLEYARD, A. (Rothamsted Experimental Station), in *The Journal of the Royal Horticultural Society*, Vol. XL, Part 3, pp. 473-475. London, April 1915.

The writer summarises the references to the use of charcoal in horticultural practice, occurring chiefly in the *Gardener's Chronicle* during the middle of the 19th century. About 1840 charcoal appears to have been much appreciated by gardeners as a medium for propagating plants and as a manure, but it appears to have waned in popularity during the next ten years.

Recently PRIANISHNIKOV of Petrovskoë (Moscow) has shown (*Revue Générale de Botanique*, 1914) that charcoal has the property of removing toxic substances from the extract of "sick" or infertile soils. Also the addition of charcoal to the soil appeared to reduce the bad effects of continuous wheat growing on this type of soil.

896 – **Cyanogenetic Character of the Genus *Ornithopus*.** — GARD, M., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 161, No. 1 (July 5, 1915), pp. 10-11. Paris, 1915.

The writer records the occurrence of a cyanogenetic compound in four species of the genus *Ornithopus*, especially *O. compressus* of the Mediterranean region and *O. perpusillus*, which, though probably originally belonging to Western Europe, extends as far as Russia.

The proportion of hydrocyanic acid in the fresh material of the two plants is as follows:

	Per cent
O. compressus (without fruits)	0.02808
O. perpusillus (with fruits).	0.01296

Boiling with strong alcohol showed that the hydrocyanic acid is wholly in combination. The compound is decomposed by an enzyme (not belonging to the emulsin group) which is present in the tissues of the plant.

897 - **Relation between the Available Phosphoric Acid in Plants and the Supply of Phosphates. Preliminary Communication.** — JAKUSHKIN, I., in *Journal Opitnoi Agronomii*, Vol. XVI, Part 2, pp. 118-139. Petrograd, 1915.

The experiments described show the following results :

1) In the case of plant tissues deficient in fatty matter, especially the stems, extraction with alcohol and ether does not sensibly affect the percentage of phosphoric acid in the acid extract.

2) The method of direct precipitation in citric acid solution may be employed for the complete separation of the mineral phosphates in phytin.

3) More accurate results can be obtained by this method in combination with that of Prof. IVANOFF, *viz.* precipitation by magnesium mixture in the presence of citric acid, followed by solution of the precipitate in nitric acid and determination of the phosphoric acid by the more certain method of NEUMAN.

4) The straw reflects much more than the grain the peculiarities of the medium in relation to phosphoric acid, whilst the proportion of phytin in the grain is to a large extent determined by the medium. The fertility of the soil is indicated most clearly by means of the percentage of mineral phosphates in the straw. When the latter falls below 0.07 to 0.10 per cent, the soil almost certainly requires phosphatic manures, whilst a percentage above 0.15 indicates a sufficient food supply.

5) Mineral phosphates of the vegetative parts are almost entirely soluble in water.

898 - **An Experimental Study of the Rest Period in Plants.** — HOWARD, W. L., in *University of Missouri College of Agriculture, Experiment Station, Research Bulletin* No. 15. pp. 3-25, 8 figs.; and No. 16, pp. 3-27, 12 figs. Columbia, Missouri, April 1915.

The first of these bulletins deals with the summer resting period of bulbs and herbaceous perennials, and the second with woody plants grown in pots.

Experiments were made with bulbs to awaken them to growth immediately after becoming dormant. One common variety of each of the following species was used: tulip, hyacinth, crocus, anemone, narcissus, oxalis, amaryllis and spring beauty (*Claytonia virginica*).

The bulbs were subjected to low temperatures and desiccation and treated with ether and chloroform either singly or in combination. The results of the treatment in all cases were negative. In some cases slight injury was noticed. Further experiments were carried out during 1909 to 1912, but without conclusive results.

In 1913 experiments were begun with the following species : Rue anemone (*Anemone thalictroides*), spring beauty (*Claytonia virginica*), dutchman's breeches (*Dicentra cucullaria*), dog tooth violet (*Erythronium mesocho-*

ium), blood-root (*Sanguinaria canadensis*), wake-robin (*Trillium sessile*), star of Bethlehem (*Ornithogalum umbellatum*), May-apple (*Podophyllum peltatum*), Jack-in-the-pulpit (*Arisaema triphyllum*), Roman hyacinth (*Hyacinthus* sp.), tulip (*Tulipa.* sp.), jonquil (*Narcissus jonquilla*) and poet's narcissus (*Narcissus poeticus*). These plants were found growing wild and were taken up for treatment early in June after dying down and becoming dormant. They were subjected to the following treatments:

1. Hypodermic injection of ether, Knop's nutrient solution, chloroform, or water before or after desiccation.
2. Exposure to ether fumes for varying periods.
3. Wounding by means of hypodermic needle.
4. Freezing for varying periods up to 7 days.
5. Desiccation at varying rates.
6. Placing in bath of warm water.

The bulbs were planted in pots in a shaded green-house and kept well watered until the middle of September, when they were placed in almost full sunlight.

The results obtained were rather inconclusive and somewhat contradictory, probably owing to the temperature of the green-house being too high. Desiccation followed by injection of Knop's solution showed a slight stimulating effect on jonquils and in a less degree on poet's narcissus. Injection with ether following desiccation gave almost equal results.

A similar series of experiments was carried out later in the autumn, and the bulbs kept at a lower temperature for the first week or two. Much better results were obtained in this case, especially with *Gladiolus* sp., *Cooperia drummondii*, *Chilianthus fragrans* and *Ornithogalum caudatum*. Desiccation followed by injection with ether and Knop's solution or in combination was the most effective method of shortening the rest period.

Experiments on herbaceous perennials were begun in 1907 with 65 species. They were transplanted from the garden to pots in a cold frame as they became dormant. The plants in the first test were all slightly frozen before transplantation; in the second none were frozen, except those given the freezing treatment; and in the third test the plants were kept in a cold frame at 55° to 65° F. until January. In the first series, nine species made no growth at all and were probably killed by the frost, and the best results were obtained by treatment with ether after drying. In the second series freezing appeared to be the most effective treatment for causing early growth, though a second freezing had less influence than freezing once. In the third series most of the plants were in leaf at the time of treatment and were more or less severely injured. Growth was accelerated in *Baptisia*, *Cassia*, *Convallaria*, *Dahlia*, *Paeonia*, *Platycodon* and *Veronica*, and very much retarded in the case of *Anthemis*, *Campanula*, *Calliopsis*, *Chrysanthemum*, *Hesperis* and *Stokesia*. It is therefore believed that many species of herbaceous perennials have a rest period and may be aroused into growth by proper treatment. Frost, desiccation and ether appear to be the most effective agents for this purpose.

Previous investigations at the Missouri Agricultural Experiment

Station have established the fact that nearly all woody plants native to th temperate zone have a rest period. Since these experiments were carrie out on twigs instead of whole plants they have been repeated with wood plants growing in pots. The collection consisted of: beech (*Fagus sylvatica* L. American ash (*Fraxinus americana* L.), flowering ash (*Fraxinus ornus* L. green ash (*F. viridus* Michx.), magnolia (*Magnolia speciosa*), white oa (*Quercus alba* L.), swamp white oak (*Quercus bicolor* Willd.), bur oak (*Que cus macrocarpa* Michx.), black oak (*Quercus nigra* L.), red oak (*Quercu rubra* L.), rose (*Rosa multiflora* Thumb, var. Crimson Rambler) and spirae (*Spiraea astilboides* Maxim, var. *floribunda*). The treatments consisted c freezing, desiccation and ether for varying periods.

The results obtained were similar to those obtained with twigs, show ing that the deaths occurring in the case of twigs were not due to the absenc of roots. The rest period is therefore a function of the buds rather than c the roots, cambium or other tissues of the tree, and it is very probabl that forced growth of the plants following the treatments takes place onl in the buds and is entirely independent of the roots, which become activ later.

The causes of the rest period and the awakening of dormant plant have not yet been investigated, but a study of the work and activities c the enzymes during the dormancy and growth is now in progress.

899 – **Specific Action of Organic Compounds in Modifying Plant Characteristics: Methy Glycocoll versus Glycocoll.** — SCHREINER, O., and SKINNER, T. T. (U. S. Dep. c Agriculture), in *The Botanical Gazette*, Vol. LIX, No. 6, pp. 445-463. Chicago, Ill., Jun 1915.

The writers have, in previous papers, given an account of the action c various organic compounds (such as creatine, histidine, asparagine, etc.. on plant growth, and the present paper describes similar experiments carrie out with glycocoll and methyl glycocoll.

The water culture method was used as before. A large series of medi was prepared, containing mono-calcium phosphate, potassium nitrate an potassium sulphate combined in various proportions. With this series, fou sets of cultures were set up, two of which received in addition 50 parts pe million of glycocoll or methyl glycocoll as the case might be, while the othe two were used as controls. Wheat seedlings were grown for 12 days, afte which the plants were removed and weighed green. The resulting weighing are summarised on the opposite page.

The presence of glycocoll affected the plants differently according t the composition of the culture solution in which they were growing. Whe nitrate was absent, growth was increased by 26 per cent; with nitrate prese to the extent of 8 parts per million (expressed as NH_3), the increase wa reduced to 6 per cent, and with double that quantity of nitrate the glycoco series gave weighings sometimes higher and sometimes lower than th control series. With regard to the absorption of nutrient salts, more potas and phosphoric acid was absorbed by the glycocoll series than by the con trol series, as would be expected from the increased growth of the plants but, on the other hand, the absorption of nitrate was less in the glycoc

No. of different culture solutions used	Composition of the culture solutions			Green weight of plants		
	P_2O_5	Nitrate as NH_3	K_2O	Control	With 50 p. p. m. glycocoll	Increase or decrease
	p. p. million	p. p. million	p. p. million	gms.	gms.	per cent
11	0-80	0	0 80	15.63	19.70	+ 26
10	0-72	8	0-72	20.27	21.42	+ 6
9	0-64	16	0-64	20.75	21.60	—
				control —	With 50 p. p. m. methyl glycocoll —	
66 (whole series)	0-80	0-80	0-80	128.03	99.3	— 33
10	8-32	24-48	24-48	24.71	16.84	— 32
11	8-48	16-56	15-56	26.10	18.70	— 29
15	8-64	8-64	8-64	29.50	22.95	— 22
27	0-72	0-72	0-72	44.72	37.32	— 16

eries than in the control series. These results indicate that glycocoll has nutritive function, that it can be absorbed by the plant and that it can eplace potassium nitrate in plant economy.

Methyl glycocoll differs from glycocoll not only in containing the methyl roup CH_3, but also in that the amido group NH_2 is thereby changed into n imido group NH. In 62 out of 66 of the water cultures, the presence f methyl glycocoll inhibited growth, causing on an average of the whole eries a decrease of 33 per cent. The roots of the plants in methyl glycocoll olution were shorter and less healthy than those of the control plants, nd the shoots grew twisted and in a lateral direction and were of a pale reen colour. By dividing up the whole series into groups according to ie composition of the nutrient solutions, it was shewn that the deleterious ffect of methyl glycocoll was most marked in the 10 best balanced solutions, *e.* in those where most growth was obtained in the normal series. The ore ill-balanced the nutrient slolution, the less was the difference between ie methyl glycocoll series and the control series.

The behaviour of glycocoll and methyl glycocoll in respect to plant rowth was confirmed by a second set of experiments which gave results entical with those described above; and in a third set of experiments, ie effect of adding calcium carbonate to the methyl glycocoll solution was so tried. The addition of this latter substance in no way mitigated the jurious action of methyl glycocoll on plant growth.

900 – **The Effect of Magnesia on Wheat and Mangolds at Woburn.** — Report o the Field Experiments 1914, of the Woburn Experimental Station of the Royal Agri cultural Society of England. — *The Journal of the Royal Agricultural Society o England*, Vol. 75, pp. 297-298. London, 1914.

Two plots of $^1/_{20}$ acre each were used in these experiments. In Octo ber 1913 one plot received a dressing of 4 cwt. of magnesia and on the fol lowing day both plots were sown with wheat at the rate of 9 pecks per acre Both plots came up well and continued so until the following spring when birds severely attacked the magnesia plot. The wheat on this plot was o a much darker colour and tillered much more than on the no-magnesia plot.

No reliable comparison of the yields can be made. Determination o the nitrogen content gave the following figures :

	With magnesia	Without magnesia
Percentage of nitrogen	1.90	1.78
Percentage of dry gluten	9.50	8.54

The magnesia treated grain resembled a strong glutinous sample o red wheat and was valued slightly higher than the untreated sample. Baking tests however showed both flours to be inert and poor working samples with apparently no difference between them.

Two other plots which had previously been under wheat, one of which had received a dressing of magnesia at the rate of 2 tons per acre in 1912 were sown with mangels in April 1914 at the rate of 7lbs per acre. A dressing of $^1/_2$ cwt. of nitrate of soda and ½ cwt. of common salt was applied in July. The leaves of the mangolds were much darker where magnesia had been applied and the crop generally looked better .

The yields were as follows :

	per acre	
	tons	cwt.
With magnesia	21	12
Without magnesia	20	18

901 – **The Influence of Copper Salts on Wheat.** — VOELCKER, J. A.: Woburn Pot Cultur Experiments 1914. — *Journal of the Royal Agricultural Society of England*, Vol. 75, pp. 306 312, 12 plates. London, 1914.

These experiments were carried out in 1914 in continuation of the previou year's experiments. By using a different soil it was found that the effect o copper salts on the growth of wheat depends to a large extent on the fertility of the soil. With richer soils the salts appear to be less toxic. Considerable differences in toxicity were noticed between the various salts, as shown by the following results :

1) Copper in the form of sulphate has an injurious effect in doses containing 0.05 per cent or more of copper. Doses containing 0.02 per cent or less may have a slightly stimulating effect.

2) Copper in the form of phosphate has a generally stimulating influence, and can be used in quantities supplying up to 0.10 per cent of copper without producing any toxic effect on the plant.

3) Copper in the form of carbonate is nearly as harmful as sulphate of copper, when used in quantities approaching 0.10 per cent of copper. With 0.05 per cent the effect is doubtful, but 0.02 per cent or less than this has a stimulating influence.

4) Copper in the form of nitrate in quantities reaching 0.02 per cent of copper is distinctly harmful, but in smaller amounts it has a stimulating influence.

5) Copper in the form of arsenite is very harmful, even in so small a quantity as 0.05 per cent.

902 – **The Influence of Lead Salts on Wheat.** — VOELCKER, J. A.: Report of the Woburn Pot Culture Experiments. — *Journal of the Royal Agricultural Society*, Vol. 75, pp. 312-313. London, 1914.

The amount of lead added to the soil in these experiments varied from 0.03 to 0.1 per cent of the soil in the form of phosphate, carbonate, nitrate, sulphate and chloride.

Germination was only retarded in the case of the nitrate of lead and the two heavier applications of the chloride. Throughout the experiment all the plants grew well, the phosphate looking best, followed by the carbonate. None of the cultures showed signs of a toxic influence. The general result points to a stimulating effect rather than the reverse. This was specially marked with the phosphate series and the nitrate one. With the carbonate and sulphate the results were very similar to the untreated and with the chloride the straw seemed to be somewhat reduced.

903 – **Morphological Researches on the Variations in Wheat, especially in the Structure of the Ear.** — DETZEL, LUDWIG, in *Landwirtschaftliches Jahrbuch für Bayern*, Year 4, No. 10, pp. 839-902, 19 plates. Munich, 1914. PLANT BREEDING

The considerable amount of material used in these researches was collected in the harvest of 1911 and showed the most varied forms, especially with regard to the shape of the ear. It was all descended from a single plant selected in 1907 from a pure line of Lower Bavarian brown wheat (Niederbayerischer Braunweizen), having a slightly different shape from the parent type, which is a lax-eared variety. The object of these studies was to determine in what manner the various principal types of wheat can be distinguished and to what extent transitions from one form to another occur, and thus to obtain information as to the origin of these various types.

The examination of the stems took into consideration the length, weight, thickness, structure and tillering, and their relation to each other and to the yield of grain. The more important results of this portion of the studies may be summarised as follows :

1) In the examination of the relations between the weight and length and the other qualities of the stem, it is preferable to use the relative weight of the stem (weight of stem per 1000 mm.) rather than its absolute weight.

2) The increase in the relative weight of the stem is accompanied i all cases by an increase in the weight of the ear and consequently an increas in the weight of the grain in the ear.

3) The increase in relative weight is followed in the majority of case by an increase in thickness of the stem. Exceptions to this rule are appa rently due to a thickening of the wall of the stem.

4) The relative weight of the stem is an indication of the " strengt of the stem" (Halmkraft), which includes its productive power in relatio both to its own development and to that of the ear.

5) It may be assumed that owing to the natural arrangement of th internal tissues the stem has a tendency to assume a regular structure in th sense defined by Novacki (according to which the better developed ste is that in which the length of each internode is the arithmetic mean of th lengths of the two neighbouring internodes), but that in the majority o cases this does not occur owing to the influence of external conditions o its development.

6) The plant possesses a certain productive power which enables i to develop a limited number of stems, but from the moment the number o stems exceeds this degree of productivity, the development of the ne stems takes place at the expense of the others and affects their later devel opment. It follows that in selecting plants for reproductive purposes th tillering power should not be taken into consideration, provided the plant have been grown in a similar environment, but rather the weight of the ea and the seeds, since the heaviest seeds are also the most productive. I practical wheat growing it should consequently be borne in mind that it i better never to force the tillering of the plants unduly, but rather to enabl them to utilise their vitality in the perfect development of a small numbe of stems and ears. In this way is obtained a stronger and more solid stra and more perfectly uniform seeds.

In distinguishing and describing the various forms of the ears of wheat the writer made use of the table of types used for plant breeding purpose at the Agricultural Institute of Weihenstephan, Bavaria, and described b KIESSLING (1). Ten different types of ear are described in this table. Fo measuring the rachis and the distances between the spikelets the write used a piece of apparatus specially designed by himself.

From the results of the measurements and weights of 500 ears of va rious types taken from more than 100 plants, the following conclusio were drawn :

The factors deciding the form of the ear are length of rachis, numb of spikelets and the growing power of the stem. The length of rachis an number of spikelets in relation to it is of most importance in determini the long narrow or short and broad type of ear. The other forms, such a club-shaped, pyramidal, oval, etc., are due to the influence of the growi power of the stem on the elongation of the rachis.

(1) KIESSLING : Die Entstehung von Dickkopfweizen (Squarehead und ähnlichen Form aus lockerährigem Landweizen. — *Illustrierte Landwirtschaftliche Zeitung*, No. 51, 1911 (*Author's note*).

It is only by the minute examination of a large number of plants taken from several different parts of the plot or field, and neglecting their different development, that a correct idea of the characteristics of a type of wheat may be obtained. This idea would be more complete if the plants examined came from several regions and from different harvests. Such a study is the only means of obtaining an exact knowledge of the typical characters of a type of wheat and of their constance and range of variation.

With the data obtained from these studies the writer discusses the origin of the different forms, and the causes of the extensive variation and arrives at the following conclusions :

1) The development and determination of the form of each plant depends on its individual assimilative power, which is a constant hereditary factor subject only to changes such as come under the head of fluctuating variability.

2) The greatest changes due to such fluctuating variability may only occur as the result of some change in the assimilative power.

3) Changes in the original assimilative power, may occur in a positive or negative sense according to the conditions.

4) An improvement in the assimilatory power may occur as the result of the influence of foreign pollen (hybridisation), whilst adverse changes in the external conditions, such as frost, may diminish the assimilatory power.

5) The phenomena known as " progressive mutation " and " negative mutation " are apparently due to the same causes.

6) Inherited improvements in a plant can only be due to hybridisation, and if there is also a great differentiation of individual assimilatory power, an abundance of diverse forms will appear in the offspring.

In a final chapter, the writer discusses the results of his researches on the productivity of different types of ear and on the distribution of the weights of the grains in the ear. This work may be summarised as follows :

1) Dense-eared types are superior to the lax-eared types and of the former the most productive form is not the club-shaped, as generally believed, but rather the oval-shaped ear.

2) In wheat selection, the exterior characters should not be the exclusive factors; the productivity determined by exact measurements and weights should also be taken into account and this productivity should always correspond to the requirements of cultural conditions.

3) The heaviest spikelets are generally the 4th and 5th of both sides of the ear.

4) These heaviest spikelets generally occur close to the middle of the rachis, the majority somewhat below it ; this rule has only a relative value, as the particular position of the heaviest spikelets of each ear depends upon the structure and growth of the rachis.

5) The heaviest grains are not necessarily found in the heaviest spikelets, but they are distributed on both sides in several spikelets from the heaviest to those towards the tip of the ear.

6) The side of the ear carrying the lowest spikelet is inferior to the other side on account of its smaller number of grains.

AGRICULTURAL SEEDS

904 – **A Study of Delayed Germination in Economic Seeds.** — Rose, D. H. (University of Chicago) in *The Botanical Gazette*, Vol. LIX, No. 6, pp. 425-444. Chicago, Ill June 1915.

A series of investigations was carried out at the Hull Botanical Laboratory, Chicago, on the causes of delayed germination in economic seed and to discover suitable means of overcoming this defect.

A new apparatus was designed for the purpose of dealing with hard coated seeds. It consisted essentially of a bank of fine needle points agains which the seeds were blown by pressure. Good results were obtained wit a variety of legume and other seeds tested. Not only was the percentag germination increased in treated seeds, but the energy of germination wa also improved.

For two varieties of lettuce it was shown that the seed improved i viability as it grew older. As the same improvement was observed whe the fresh seeds were treated in the above-mentioned machine for dealin with hard coats, it seems probable that the better germination of the olde lettuce seed was due to increased permeability to water of the inner see coat.

Slow-germinating conifer seeds were treated with water and weak hy drochloric acid in two ways : *a*) by mere soaking, and *b*) by injecting, *i.e* exhausting the air from the seeds when in the liquids and then restoring th pressure to normal, thus forcing the liquid into the seeds. When injecte with distilled water, seeds gave better germination than when merel soaked in water or in weak acid at 3°-5° C., indicating that delayed germi nation is due to lack of water intake rather than to an alkaline or neutra reaction of the embryo. Any kind of soaking or injection improved th germination, and cold storage in wet sand was markedly beneficial in th case of *Pinus strobus* and *Cupressus macrocarpa*.

Samples of frosted oats and peas were tested under various conditions Certain samples of oats were shewn to regain their viability as they grew older, but this recuperation could not be counted upon, and frosted oat can only be considered as of very doubtful value for seed. Frosted garden peas were shewn to be damaged in two ways : *a*) by actual injury to the em bryo, and *b*) by the presence of fungi on the seed coat. By removing th latter the germination of such seeds was in many cases improved.

905 – **Joint Regulations (Revised) of the Secretary of the Treasury and Secretary o Agriculture under the Seed Importation Act. Approved August 24, 1912.** (1) — *U. S. Department of Agriculture, Bureau of Plant Industry, Service and Regulatory An nouncements*, May 1915, pp. 9-14. Washington, June 17, 1915.

REGULATION I. — SHORT TITLE OF THE ACT.

The act " To regulate foreign commerce by prohibiting the admissio into the United States of certain adulterated grain and seeds unfit for seed

(1) See *B.* Feb. 1913, No. 182. (*Ed.*).

ng purposes," approved August 24, 1912, shall be known and referred to as " The seed importation act of August 24, 1912."

REGULATION 2. — DEFINITIONS.

(*a*) *Clover.* — The term " clover " shall include :

rifolium hybridum	alsike clover.
rifolium incarnatum	crimson clover.
rifolium pratense	red clover.
rifolium repens	white clover.

(*b*) *Dodder.* — The term " dodder " shall include all species of *Cuscuta*.

(*c*) *Millet.* — The term " millet " shall include :

haetochloa italica (*Setaria italica*)	Hungarian or German millet.
anicum miliaceum	broom-corn millet.

(*d*) *Rape.* — The term " rape " shall include the forms of *Brassica apus*, winter rape, commonly grown as forage, but shall not include the orms of *Brassica napus*, summer rape or bird rape, commonly grown for ts seed.

(*e*) *Sorghum.* — The term " sorghum " shall include the saccharine arieties of *Holcus sorghum* (*Sorghum vulgare*).

(*f*) *Kafir corn.* — The term " Kafir corn " shall include the non-accharine, or grain, varieties of *Holcus sorghum* (*Sorghum vulgare*), xclusive of broom corn.

(*g*) *Weeds.* — The following plants shall be considered weeds :

butilon theophrasti (*A. avicennae*)	Indian mallow.
chillea millefolium	yarrow.
gropyron repens	quack-grass.
grostemma githago (*Lychnis githago*)	corn cockle.
llium vineale	garlic, wild onion.
lsine (*Stellaria*)	chickweed.
maranthus	amaranth.
mbrosia	ragweed.
nagallis arvensis	pimpernel.
nthemis	Mayweed.
nthyllis vulneraria	kidney vetch.
triplex	saltbush.
vena fatua, Avena fatua glabrescens	wild oats.
xyris amaranthoides	—
rteroa incana (*Alyssum incanum*)	hoary alyssum.
assica	mustard.
Except *B. napus* (winter rape).	
omus hordeaceus, Bromus racemosus, Bromus secalinus, *Bromus tectorum*	chess.
rsa bursa-pastoris (*Capsella bursa-pastoris*)	shepherd's-purse.
melina	false flax.
mpe (*Barbarea*)	winter cress.

Carduus (including *Cnicus*)	thistle.
Carex	sedge.
Centaurea	star thistle, cornflower.
Cerastium	mouse-ear chickweed.
Chaetochloa glauca (*Setaria glauca*)	yellow foxtail, pigeon grass.
Chaetochloa viridis (*Setaria viridis*)	green foxtail.
Chenopodium	lamb's-quarters.
Chrysanthemum leucanthemum	oxeye daisy.
Cichorium intybus	chicory.
Conringia orientalis	hare's-ear mustard.
Convolvulus	bindweed.
Cuscuta	dodder.
Datura	jimson weed.
Daucus carota	wild carrot.
Echinochloa crus-galli (*Panicum crus-galli*)	barnyard grass.
Echium vulgare	blueweed.
Eragrostis	stink-grass.
Erodium cicutarium	alfilaria.
Eruca sativa	rocket (roquette).
Erysimum	treacle mustard.
Festuca myuros	rat's-tail fescue.
Galium	bedstraw.
Geranium	crane's-bill.
Grindelia squarrosa	gumweed.
Helianthus	sunflower.
Hibiscus trionum	bladder ketmia.
Hieracium	hawkweed.
Holcus halepensis (*Sorghum halepense*)	Johnson grass.
Hypochaeris radicata	cat's-ear.
Ipomoea	morning-glory.
Iva	marsh elder.
Juncus	rush.
Lappula echinata (*Echinospermum lappula*)	stickseed.
Lappula texana (*Echinospermum redowskii*)	stickseed.
Leontodon autumnale	fall dandelion.
Leonurus cardiaca	motherwort.
Lepidium	peppergrass.
Linaria	butter-and-eggs; toadflax.
Lithospermum arvense	corn gromwell.
Lolium temulentum	darnel.
Lotus	bird's-foot trefoil.
Lychnis	campion.
Madia sativa	tarweed.
Matricaria inodora	scentless camomille.
Medicago arabica (*M. maculata*)	spotted bur clover.
Medicago hispida denticulata (*M. denticulata*)	toothed bur clover.
Medicago lupulina	yellow trefoil.
Melilotus	sweet clover.
Molinia coerulea	—
Nepeta cataria	catnip.
Neslia paniculata	ball mustard.
Notholcus (*Holcus*)	velvet grass.

Oenothera biennis	evening primrose.
Picris	oxtongue.
Plantago	buckhorn; plantain.
Polygonum	knotweed; bindweed; smartweed; lady s-thumb.
Portulaca oleracea	purslane.
Potentilla	five-finger.
Prunella vulgaris	heal-all.
Ranunculus	buttercup.
Raphanus raphanistrum	wild radish.
Rosa	wild rose.
Rudbeckia hirta	brown-eyed Susan.
Rumex	dock; sorrel.
Salsola	Russian thistle.
Sanguisorba	burnet.
Sherardia arvensis	field madder.
Silene	catchfly.
Sisymbrium	tumbling mustard.
Solanum	nightshade.
Sonchus	sow thistle.
Spergula	spurry.
Syntherisma (*Digitaria*)	crab-grass.
Taraxacum	dandelion.
Thlaspi arvense	Frenchweed.
Tragopogon pratensis	goat's-beard.
Trifolium	wild clover.
Except *T. hybridum*, *T. incarnatum*, *T. pratense*, and *T. repens*.	
Vaccaria pyramidata (*Saponaria vaccaria*)	cow cockle.
Valerianella locusta (*V. olitoria*)	corn salad.
Verbena	verbena.
Vicia	vetch.

REGULATION 3. — SAMPLING.

The collector of customs shall draw and forward for examination, without specific request from the Secretary of Agriculture, samples of all seeds of alfalfa, Canadian blue grass, Kentucky bluegrass, millet, orchard-grass, rape, redtop, timothy, clover, meadow fescue, and awnless brome-grass, when entered for consumption, whether or not a consular invoice is presented on the entry thereof.

Samples of shipments of the other seeds enumerated in the act shall be drawn and forwarded only when the Secretary of Agriculture shall make specific request for such samples.

REGULATION 4. — DRAWING SAMPLES.

When a shipment is made up of several lots differing in quality or price, a sample of each lot shall be submitted as though each lot were a separate shipment. The sample of each lot or shipment submitted to the

seed laboratories, in accordance with regulation 5, shall be drawn as follows: When a lot consists of five sacks or less, each sack shall be sampled, and when consisting of more than five sacks, every fifth sack, but not less than five sacks, shall be sampled.

REGULATION 5. — SAMPLES, WHERE SENT.

All samples drawn under the act by customs officers shall be forwarded to the respective seed laboratories under which the ports are grouped in the following list of seed-laboratory districts unless otherwise specifically requested by the Secretary of Agriculture or his representative.

REGULATION 6. — NOTICE TO CONSIGNEE.

The collector of customs shall immediately notify the consignee that samples have been drawn and that the remainder of the shipment must be held intact, pending a decision of the Secretary of Agriculture in the matter.

REGULATION 7. — EXAMINATION OF SEEDS—DELIVERY IN BOND.

Seeds offered for importation into the United States from any foreign country, after samples of each lot have been taken for examination, shall be admitted only after the samples have been examined and pronounced to be neither adulterated nor unfit for seeding purposes within the meaning of the seed importation act of August 24, 1912: *Provided, however,* That collectors of customs may deliver to consignees shipments which have been sampled on the execution of a bond in a sum equal to the invoice value of the seeds, together with the duty thereon, if any, conditioned upon the delivery of the shipments, or any part thereof, to the collector when demanded by him for any reason.

REGULATION 8. — RELEASE OR RECLEANING OF SHIPMENT.

If the Secretary of Agriculture shall inform the collector that the seeds are not in violation of the said act, the collector shall no longer detain the shipment under that act, and the bond, if any, given pursuant to regulation 7 shall be canceled; but if the seeds are found to be in violation of the said act, the collector may permit the importer to reclean the seeds under bond at the expense of the importer, in accordance with regulations 9, 10, and 11.

REGULATION 9. — SAMPLES OF RECLEANED SEEDS.

The collector of customs shall draw and forward to the Secretary of Agriculture or his representative a sample of the recleaned seeds, together with a sample of the screening or other refuse removed from the seeds in

the course of cleaning, accompanied by a statement of the amount of both the recleaned seeds and of the screenings, and the same procedure shall be followed with respect to such sample of the recleaned seeds as upon the original sample.

REGULATION 10. — EXPORTATION OF SHIPMENT.

If the Secretary of Agriculture shall inform the collector that the sample of the recleaned seeds is not satisfactory, or if the importer shall decline to reclean any shipment of seeds which the Secretary of Agriculture has found to be in violation of the said act, the collector shall refuse delivery of the shipment and require it to be exported under customs supervision.

REGULATION 11. — DISPOSITION OF REFUSE FROM RECLEANING.

If the Secretary of Agriculture shall inform the collector that any seeds which have been recleaned pursuant to regulation 8 are not adulterated and are fit for seeding purposes, such seeds may be released to the owner or consignee upon condition that (1) the screenings or other refuse removed in the course of recleaning shall have been ground or otherwise treated under customs supervision so as to render any seeds contained therein incapable of germination, or (2) such screenings or other refuse shall have been exported under customs supervision, or (3) such screenings or other refuse shall have been sacked, sealed, and tagged to the satisfaction of the collector, and are retained subject to the conditions of the bond given pursuant to regulation 7 to secure delivery of the shipment. Screenings and other refuse retained in accordance with this regulation may be recleaned at any time within 12 months from the date of the entry of the shipment. Unless recleaned within said period of 12 months, or ground or otherwise treated under customs custody so as to render any seeds contained therein incapable of germination, such screenings or other refuse shall be exported under customs supervision.

REGULATION 12. — IMPORTED SEED IN VIOLATION OF THE SEED-IMPORTATION ACT NOT TO BE MIXED WITH OTHER SEED.

Mixing any seed with a lot or shipment of imported seed which has been found to be in violation of the seed-importation act of August 24, 1912, is prohibited.

REGULATION 13. — NOTICE OF REMOVAL FROM PORT OF ENTRY.

The collector of customs will notify the Secretary of Agriculture whenever seed which has been sampled under the seed-importation act is moved from one port to another port before being finally released.

REGULATION 14. — DISPOSITION OF DETAINED SHIPMENTS TO BE REPORTED.

The collector of customs shall inform the Secretary of Agriculture of the disposition made of every shipment detained under these regulations.

REGULATION 15. — FAILURE TO EXPORT TO BE REPORTED.

Should the importer fail to export within three months from the date of refusal of delivery any seeds the delivery of which has been refused under these regulations, the collector shall report the facts to the Secretary of the Treasury and to the United States attorney.

REGULATION 16. — WILLFUL VIOLATION TO BE REPORTED.

The collector of customs shall report to the Secretary of the Treasury and to the United States attorney any willful violation of the act which shall come to his knowledge.

REGULATION 17. — APPEAL TO THE SECRETARY OF AGRICULTURE.

All applications for relief from decision as to the quality of seeds arising under these regulations should be addressed to the Secretary of Agriculture.

REGULATION 18. — FORWARDING OF SAMPLES OF ALL FORAGE-PLANT SEEDS.

Irrespective of the foregoing regulations, collectors of customs will forward to the Seed Laboratory, United States Department of Agriculture, Washington, D. C., 2-ounce samples of each lot of all grass, clover, and other forage-plant seeds imported into the United States.

REGULATION 19. — TAKING EFFECT OF REGULATIONS.

These regulations shall supersede all previous regulations under the seed-importation act of Augusr 24, 1912, and shall take effect May 15, 1915.

CEREAL AND PULSE CROPS

906 - **Inquiry into the Cultivation of Cereals in Tunis.** — BOEUF, F. (in the northern region during harvest 1914) and ROBINET (in the southern region) in *Bulletin de la Direction Générale de l'Agriculture*, Year 19, No. 83, pp. 135-154 and pp. 155-170. Tunis, 1915.

These observations relate to the influence of the conditions of the soil and cultural operations on the yield, and account for the resistance of cereals to exceptional drought, thus providing information of practical use.

I. — As a result of the study of the soil and the systems of cultivation in the different regions, the writer makes the following conclusions: The minimum rainfall necessary to the crop varies according to the nature of the soil and especially to the previous cultivation to which the soil has been submitted. Whilst a minimum of 380 mm. of rain is necessary for a passable yield in Northern Tunis, much more satisfactory yields have been obtained with much less rain, when the preparation of the soil was well done and especially when deep tillage was carried out for 1, 2 and even 3 years. With a rainfall of only 282.5 mm. at Hassen-Bey a yield of 28 bu. was obtained, whilst at Ben-Alech with a rainfall of 203.5 mm. a yield of

19 bu. per acre was obtained. Thus under good conditions of cultivation the minimum rainfall required for a crop of wheat is from 200 to 250 mm. (1).

The influence of the nature of the soil, though important, does not preponderate. It may be corrected by preparatory cultivation which should be done earlier and more thoroughly as the land is heavier. A final tillage immediately before sowing favours the rapid growth of the seedlings and enables them to overcome the growth of weeds. In a dry year there is no danger from late sowing if the land has been well prepared, for the regular and rapid growth of the cereal enables the crop to resist weeds better than an early crop growing irregularly and incompletely owing to hasty sowing.

The greatest enemy of cereals is foreign vegetation, whether from the previous crop or appearing adventitiously with the cereal. This harmful effect is undoubtedly due to the consumption of the soil water which is obtained at lower depths by grasses, as well as the absorption of mineral matter. It is probable that the nutritive solutions of the mineral elements are only produced slowly in dry regions. A dry soil is, so to speak, a dead soil, requiring the presence of moisture, bacterial action and disintegration processes. There is therefore the double necessity of maintaining the soil fresh for as long a period as possible by manuring and the suppression of all growth which would remove the available fertility.

Cultivated fallow fulfils both conditions and appears to act more by conserving the soil fertility for a longer time than by increasing the reserves of soil moisture.

Heavy seeding is recommended to check the growth of weeds in cereals. Thin seeding gives more space to the weeds, favours heavy tillering and late growth more subject to scorching. There should be no hesitation in weeding cereals which have not come up well. A second horse-hoeing is only recommended in regions where the spring is not generally rainy.

Manures should always be applied to cereals with caution and in repeated small dressings owing to the danger of an excessive vegetative growth which is more subject to scorching.

II. — The inquiry in South Tunis was directed to the study of the factors favourable to the development of cereals in dry seasons and to determine to some extent their functions. This was done by circularising about twenty agriculturists with series of questions.

The cereals may be classed according to their resistance to drought in the following increasing order: oats, barley, wheat. Light sandy soils not liable to movement and sufficiently deep and well cultivated according to dry farming principles are capable of giving crops of cereals even in unfavourable seasons.

907 - **Growing Hard Spring Wheat in the United States.** — BALL, CARLETON R., and CLARK, J. ALLEN., in *United States Department of Agriculture, Farmers' Bulletin*, No. 678. 16 pp., 3 figs. Washington, D. C., June 10, 1915.

Spring wheat is chiefly grown in the northern part of the Great Plains. It covers the Dakotas and Minnesota and is extensively raised in Washington, while the edges of its area overlap the surrounding States.

(1) See *B.* Aug. 1912, No. 1162. (*Ed.*).

The three prairie provinces of Canada are covered by a very similar spring wheat field.

In 1909, about 17 million acres of land, of which 16 millions in the Dakotas and Minnesota, were under hard spring wheat. This was more than one-third of the total wheat acreage of the United States in that year. Of the nearly 17 million acres of hard spring wheat, about six-sevenths are common wheat and one-seventh durum wheat.

908 – **Continuous Growing of Wheat and Barley and the Liming of Acid Soils.** – VOELCKER, J. A. : (Field Experiments at the Woburn Experimental Station. — *Journal of the Royal Agricultural Society of England*, Vol. 75, pp. 287-293 and 315-318. London, 1914.

This report deals with the results of the 38th season of the continuous growing of wheat and barley at Woburn. The experiment consists of 22 plots manured in various ways. Owing to the dry season the crops matured earlier than usual and in the case of wheat were much smaller.

I. — *Wheat experiments.* — The mineral manures (superphosphate and sulphate of potash) as usual gave no increase. Sulphate of ammonia alone gave no crop and with minerals (without lime) the yield was slightly above the control ; but minerals with the heavier dressing of sulphate of ammonia gave no increase. Sulphate of ammonia with lime applied in 1897 gave an average crop, showing the persistent effect of the lime, but in the case where a second dressing of lime had been applied in 1905 the yield was much lower.

The best yields were obtained with rape dust and sulphate of ammonia together with minerals and lime. The worst were those grown with nitrate of soda.

II. — *Barley experiments.* — Mineral manures gave a slight increase over the control plots. Sulphate of ammonia alone or with minerals without lime gave no crop in any case. The application of 1 ton of lime per acre in 4 different applications (1905,1909, 1910 and 1912) of 5 cwt. each in addition to the sulphate of ammonia gave a yield less than one-half the control. The addition of 2 tons of lime in 1897, and again in 1905 gave a slight increase, but a further addition of 2 tons in 1912 resulted in a considerable increase, almost equal to that obtained with farmyard manure which was the highest of all the plots. Nitrate of soda was generally unsatisfactory and gave crops of poor quality.

III. — *Experiments on the acidity of soils.* — It has been shown in field and pot culture experiments that the acidity due to the prolonged use of sulphate of ammonia on soils poor in lime can be entirely corrected by applications of lime. Certain anomalies however have appeared ; for example in the continuous wheat experiments above mentioned the application of 4 tons of lime per acre has not produced such a good crop as in the case of a single application of 2 tons of lime per acre in 1897. This deterioration did not occur in the barley plots. Pot culture experiments were therefore carried out to determine whether this effect was due to the causticity of the lime and whether calcium carbonate could be used in correcting the acidity of the soil. Soil was taken from the following plots under continuous barley : 1. Unmanured ; 2. Sulphate of ammonia alone ; 3. Sul-

phate of ammonia with 4 tons of lime per acre ; 4. Mineral manures and sulphate of ammonia ; 5. As in 4 with 4 tons of lime per acre ; 6. Mineral manures and sulphate of ammonia (double-dressing) and 4 tons of lime per acre.

Each of these soils was subjected to three methods of treatment : 1) carbonate of lime required to make the soil just neutral; 2) carbonate of lime 50 per cent in excess of neutrality ; 3) untreated.

The general results of these cultures are summarised as follows : In plots 2 and 4 the growth was increased in proportion to the amount of lime added and the untreated crop died, thus showing that where soil acidity has developed to the extent that a crop cannot be produced, carbonate of lime may be advantageously applied to an extent in excess of that required for neutrality.

In plots 1 and 3 no marked differences were observed with the various treatments, so that although the soil was acid no advantage was obtained by adding carbonate of lime. In plots 5 and 6 no acidity was shown and further liming was only wasteful. In no case was there any harmful effect from the use of carbonate of lime, thus showing that the harmful effect of the second dressing of lime in the continuous wheat series was due to the causticity of the lime applied.

909 - **Sulphuring of Cleaned Barley and Treating it with Talc in Germany.** — PLÜCKER, W., and PLEBBE, R., in *Zeitschrift für das gesamte Getreidewesen*, Year 7, No. 3, pp. 57-58. Berlin, March 1915.

Of recent years a special process for the preparation of cleaned barley for the market has been in use in Germany. The cleaned barley is first treated with sulphur, generally sulphurous acid, in order to disinfect it, and then polished with talc to fill up the pores of the grain. By this process a sterile product is obtained suitable for storage over long periods. The Imperial Office of Hygiene at Berlin has several times condemned this product and demanded its prohibition. The manufacturers' federation thereupon submitted to the Imperial Chancellor a report explaining the objects of this process. The Office of Hygiene repeated its investigations and came to the conclusion that the use of a small quantity of sulphurous acid (20 mgms. per 100 grms. of cleaned barley) is not harmful, but that the use of talc is unnecessary and should therefore be condemned.

The writers have re-investigated this question and examined a large number of barley grains treated by this method. They find that the sterilisation of the grains by means of sulphurous acid is quite unnecessary since all the bacteria on the surface of the grain are destroyed by machine cleaning. The suphurous acid treatment only effects a partial sterilisation of the grain. They are therefore led to believe that the chief object of the sulphuration process is not sterilisation, but bleaching. It is practised particularly with Russian barley, which, being pigmented, is of less value in Germany than the home-grown grain. Thus, by bleaching it the value of this cheaper barley is increased.

With regard to the talc treatment it was shown that the keeping qualities of the grain were not improved thereby. This process also is for bleach-

ing purposes rather than preservative. The use of talc should therefore be forbidden unless in proportions less than 0.5 per cent, and its presence should always be declared.

910 – **Origin of Cultivated Oats.** — TRABUT, in *Le Progrès Agricole et Viticole*, Year 36, No. 29, pp. 59-66. Villefranche, July 18, 1915.

The writer has previously recorded a variety of oats known as "Algerienne", very resistant to rust and drought. Recent experiments at the Cape and in Australia have shown its suitablity to these countries and its cultivation has been considerably extended.

Investigations of Algerian Gramineae have shown a series of forms of *Avena sterilis* occurring in Northern Africa and Southern Europe, and from a comparative and morphological study of these the writer concludes that the Algerian oats is a form of *Avena sterilis* modified by cultivation, whilst the cultivated oat of Europe is derived from *Avena fatua*. Cotinuing these studies he finds that *A. strigosa* is a cultivated form of *A. barbata*, whilst *A. wiestii* has given rise to *A. abyssinica*. Thus, in short, the old *A. sativa* includes cultivated oats derived from at least four wild species.

These facts are of great practical value. In southern countries where *A. sterilis* occurs wild the Algerian oat will succeed, and the cultivated varieties derived from *A. fatua* are only suitable for more northern and higher regions where the wild forms of this species are found.

The Algerian type is characterised by the absence of articulation in the second grain, which remains adherent for a long time. Each of the grains is provided with a more or less twisted awn.

The varieties of this species have not yet been the subject of minute investigations, but the following types may already be distinguished:

a) prolific races with more than 50 spikelets,
b) races with a single reduced awn,
c) races with three grains to the spikelet.

Selection according to the density of the grains is a rapid means of improving the crop. Hybridisation also gives interesting results. Hybrids with Ligovo oats introduced into Algeria from Australia have shown constancy and immunity. The progeny of these hybrids will probably replace the Algerian varieties, the glumes of which are too hard to make them popular. These new types are winter oats which tiller well and grow vigorously during the winter, like all the varieties of *A. sterilis*.

911 – **Oats in the Great Plains Area: Relation of Cultural Methods to Production.** — CHILCOTT, E. C.; COLE, I. S.; and BURR, W. W. — *U. S. Department of Agriculture, Bulletin* No. 218, 42 pp. Washington, May 28, 1915.

This bulletin contains a study of the yields of oats from different methods of cultivation and seed-bed preparation at fourteen field stations on the Great Plains.

The area covered by these investigations is about 400 000 square miles; it includes the western parts of North and South Dakota, Nebraska, Kansas, Oklahoma and Texas and the eastern parts of Montana, Wyoming, Colorado and New Mexico. In all this area the determining factor in crop production is the limited rainfall, which is also uncertainly distributed.

TABLE I. — *Cost per acre of producing oats in the shock in the Great Plains area.*

Method of preparation	Operations carried out	Cost of production	Cost per acre				Total cost of production	
			Seed	Drilling	Harvesting	Interest and taxes	In dollars	In bushels of grain at 30 cents
Disked maize land	Harrowing and disking	$ 0.97	$ 0.60	$ 0.40	$ 0.93	$ 1.60	4.50	15.0
Listed	Harrowing, disking and listing	1.77	0.60	0.40	0.93	1.60	4.30	17.7
Spring ploughed	Ploughing, harrowing, disking	2.31	0.60	0.40	0.93	1.60	5.84	10.5
Autumn ploughed	do. do. do.	2.78	0.60	0.40	0.93	1 60	6.31	21.0
Subsoiled	do. do. and subsoiling	3.30	0.60	0.40	0.93	1.60	6.92	23.1
Summer tilled	Ploughing, harrowing and disking	6.12	0.60	0.40	0.93	3.20	11.25	37 5
Green manured:								
With rye*	do. do. do. and drilling	7.73	0.60	0.40	0.93	3.20	12.86	42.9
With peas**	do. do. do. do.	10.73	0.60	0.40	0.93	3.20	15.80	52.9
						Average cost of green manuring	14.36	47.9

* The cost of rye per acre for seed in estimated al $ 1.
** » peas » » » at $ 4.

The same variety of oats is used on all the plots at a particular station during any one year, that is, the best available for general use. But the same variety was not used at all the stations.

A table is presented for each station. From the records of eight representative stations the data given in Table I have been compiled, while the following conclusions are drawn from a comparison of the results obtained in all the stations.

Conclusions.

The relatively poor adaptation of oats to the southern section of the Great Plains cannot be overcome by cultivation.

Seasonal conditions cause much wider variations in yields than can be caused by differences in cultivation.

When the results of a series of years are averaged, the great differences which are obtained only in exceptional years tend to be reduced considerably.

At stations north of Hays (Kansas), spring ploughing has been generally more productive than autumn ploughing. At Hays and the stations south of it, autumn ploughing has been in about an equal degree better than spring ploughing.

At Garden City (Kansas) and all stations north of North Platte, disking corn ground has been productive of higher average yields of oats than either autumn or spring ploughing.

The yields by subsoiling have not departed much from those by ordinary ploughing. Subsoiling has not proved profitable.

At all stations where it has been tried, listing for oats has been either more profitable or has resulted in less loss than autumn ploughing.

Green manuring has been productive of higher yields than either autumn or spring ploughing or disking maize ground at nine of the thirteen stations from which results are reported. The cost of production by this method was so high that it showed a profit at only two stations.

Oats following summer tillage produced the highest average yields at all stations except Hettinger, where the yield was exceeded only by that on disked maize ground. While the expense of the method has prevented its being the most profitable, the degree of insurance it affords against failure of the crop might jnstify its practice in at least some sections.

Disking maize ground yielded the highest profits of any method tested at all stations except at two.

The above averages have been obtained from the results of 14 stations during a number of years varying from 2 to 8 (average 5 years) Only the figures in the 1st, 2nd, 5th and 7th lines are comparable as the others are averages of incomplete series.

TABLE II. — *Average yields of oats by different methods in the Great Plains area.*

	Average yield. Bushels per acre
Autumn ploughed	24.4
Spring ploughed	25.8
Listed	24.1
Subsoiled	24.7
Disked	28.3
Green manured	28.7
Summer tilled	34.3

912 – **The Principal Varieties of Maize in Tonking.** — GILBERT, H., in *Bulletin Economique de l'Indochine*, Year 17, No. 110, pp. 625-628. Hanoï, Sept.-Dec., 1914.

An agronomic station has been established in Tonking by the Governor-general of Indo-China, specially for experimental researches on the cultivation of maize. The writer, sub-inspector in the Agricultural and Commercial Service, was appointed to obtain information on the production of this cereal in the chief producing districts and to make a collection of typical ears for study. In the district of Bac-Ninh four chief varieties are found: 1) a yellow large-grained variety; 2) a yellow smaller-grained variety; 3) a white variety and 4) a glutinous maize. The two yellow-grained varieties are extensively cultivated in this district. The typical ears of the yellow large-grained maize average 5.9 inches in length and are almost cylindrical in shape with 14 rows of 30 to 35 thick-skinned grains. The yield varies between 890 and 1350 lbs. of dried grain per acre. The typical ears of the yellow small-grained maize are 5.1 in. in length with 14 rows of 25 grains. The yield of this variety averages 1100 lbs. of dried grain per acre. The same varieties are also found in the Vinh-yên district, besides another with small yellow grains and seven leaves, giving a small yield which is entirely consumed locally.

In the districts of Son Tay and Thanh-Thuy the varieties grown are the same as in other parts of the Delta, but the yellow large-grained type reaches a height of 11 feet and gives a yield of 1800 lbs. per acre.

In the Van Linh district there is a very pure race of white maize which appears peculiar to this district. It grows to the height of 5 feet and has 9 leaves; the ears are 4.7 inches long with 10 rows of 25 slightly flattened grains. The yield does not appear to exceed more than 1100 lbs. per acre.

913 – **Comparative Values of Immature and Ripe Tubers for Seed. Experiments in the Cultivation of Potatoes at Longatha, Victoria, Australia.** — RAMSAY, J. C. (Potato Expert) in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XIII, Part 6, pp. 340-348, 5 figs. Melbourne, June 1915.

STARCH CROPS

The results given in the following table show that in using immature tubers for seed, not only was the harvest more abundant, but the proportion of marketable sized potatoes was greater. The manuring used for this series of experiments was the one that gave the best results when compared with other incomplete manuring.

Crop from immature and from ripe tubers.

Class of seed	Yield per acre.								
	Large			Small			Total		
	Tons.	cwt.	lbs.	Tons.	cwt.	lbs.	Tons.	cwt.	lbs.
Immature, manured	7.	15.	0.	0.	17.	56.	8.	12.	56.
» not manured	3.	15.	0.	1.	5.	0.	5.	0.	0.
Ripe, manured	4.	5.	0.	1.	7.	56.	5.	12.	56.
» not manured	2.	2.	56.	1.	5.	0.	3.	7.	56.

The rate of application of the complete manuring was as follows: Superphosphate, 2 cwt.; sulphate of potash, 1 ½ cwt; sulphate of ammonia, 1 cwt.; basic slag, 1 cwt. per acre.

FORAGE CROPS. MEADOWS AND PASTURES

914 – **Hard Clover Seed and its Treatment in Hulling.** — HARRINGTON, GEORGE T. (Scientific Assistant, Seed Laboratory), in *U. S. Department of Agriculture, Farmers' Bulletin*, No. 676, 8 pp. Washington, June 24, 1915.

By hard seeds is meant seeds whose seed-coats are impervious to water. They germinate only after they have lain in the ground a long time. Though in some exceptional cases this may be an advantage, as a rule seeds which germinate rapidly are of greater value.

The percentage of hard seeds in commercial lots of red clover, alsike clover and white clover is comparatively small. In commercial lots of sweet clover the proportion varies from less than 10 per cent in some lots to more than 90 per cent in others. The writer, however, has found a very large percentage of hard seeds in hand-harvested and hand-hulled lots of each of these four kinds of clover. He investigated the reason for this difference and also the relation of other factors to the character and size of the clover-seed crops, and obtained the following results.

In nature, nine-tenths or more of the well matured seeds of the four clovers above-mentioned are hard. The hardness of well-matured clover seed is not influenced materially by conditions of soil, by seasonal variations, by climatic conditions, or by the time at which the seed is harvested, nor is it related to the colour or size of the seed.

The rotting of the clover in field or stack or sweating it in the mow before hulling, with a view to obtaining a lower proportion of hard seed is not necessary; on the contrary, to secure the greatest yield and highest quality of seed the clover should be cured and stored with as little wetting as possible.

The rubbing which clover seed receives in the hulling machine greatly reduces the proportions of hard seeds, but frequently breaks some of the seeds.

The work of the clover seed huller is therefore effective. The aim should be to have it so constructed and so operated as to reduce the propor-

tion of hard seeds to the greatest possible extent and at the same time to break the smallest possible number of seeds.

The influence of the construction of the hulling machine upon the condition of the seed was shown by samples of hulled clover seed treated by six different machines, one of which yielded an average of 10 hard seeds per 100, both for red clover and alsike clover, while another machine gave averages of 36 and 37 per cent respectively. The other machines were intermediate in their proportion of hard seeds.

915 - **Olive Growing in California.** — BROSIUS, FRED C., in *The Country Gentleman*, Vol. LXXX, No. 20, pp. 878-879, 3 figs. Philadelphia, May 15, 1915.

The olive was first introduced into California in 1769 (at San Diego) from San Blas, Mexico. The trees throve for over one hundred years in the southern part of the State, before they were introduced further north, and it was not until about 30 years ago that the first regular commercial groves were planted in the central and northern parts of the State. Owing to inexperience many serious mistakes were made, resulting in financial loss, but now olive growing has passed the experimental stage and is recognized as one of the safest and most profitable of all the many branches of horticulture in California.

In Southern California the districts suitable for olive growing are fast being filled with citrus, date and walnut plantations, and as the olive is not adapted to the humid coast districts, future plantings must be done in the warm interior valleys of Central and Northern California.

Surrounding these two great valleys on the east and west sides, following the fertile foothills at an altitude of from 100 to 1400 ft. above sea-level, there exists a well-defined thermal belt, and it is within this district that the olive tree has found its ideal climatic and soil conditions.

There are but two other States of the Union that can produce the olive commercially, namely Florida and Arizona; owing to the susceptibility of the olive tree to the low temperatures of the North and its non-bearing in the humid atmosphere of the Gulf States, its future expansion is limited to a very small area; in fact at present there are but 360 acres producing olives commercially outside of California.

An idea of the amount and value of olive products annually consumed, together with the estimated production within the United States, may be gained from the following table:

Imports	Oil — gallons	Pickles — gallons	Valu — $
1910 June 30	4 545 136	4 555 075	7 106 594
1911 »	4 984 804	3 044 947	7 960 556
1912 »	5 472 528	5 076 857	8 863 154
1913 »	5 840 357	2 946 076	9 043 228
1914 »	6 981 484	5 316 364	10 687 027

U. S. Production	Oil — gallons	Pickles — gallons	Value — $
1911 June 30	290 800	1 105 970	1 760 270
1912 »	912 000	1 232 000	3 274 000
1913 »	200 000	1 500 000	3 200 000
1914 »	1 075 000	1 100 000	3 256 000

The acreage in California in 1914 was as follows :

	Bearing	Non-bearing	Total
Southern California	5 489	3 671	9 160
Central »	1 793	1 548	3 341
Northern »	5 779	2 731	8 510
	13 061	7 950	21 011

Besides the annual rainfall, the olive requires during the growing season about 18 inches of irrigation water, which is usually supplied through pipes or ditches from near-by mountain streams at a cost of 3 to 6 dollars an acre.

When irrigation is not available, a well and pumping plant may be installed at an average cost of $ 275 for 10 acres.

During the earlier plantings olives were set very close together, but now they are set thirty feet apart each way or forty-eight trees to the acre. During the first years the space between the trees is often interplanted with peach or plum trees that are later removed, or, for the first five or six years, maize, beans, peas, potatoes, berries and sometimes melons or other vegetables are profitably grown. Maize and sorghums are often beneficial in forming wind-breaks for the young trees.

The Mission, a direct descendant from the first olives planted in the State, is the most popular variety planted. The Sevillano or Queen and the Manzanillo are being more extensively planted as their treatment for market is better understood.

The Nevadillo is one of the best oil varieties, but it is very little planted now as the smaller sizes of all varieties are used for pressing oil or for making olive paste, a new but much esteemed condiment.

From actual statistics covering a period of years, the writer finds that the total expenditure on ten acres of olives for the first ten years including planting, cultivating, irrigating, pruning, harvesting, hauling, implements, taxes and interest, allowing $ 200 an acre for the purchase of land, amounts to about $ 5 700. The returns from the olives from the fifth to the tenth year net about $ 6 000, so that the olive grove if properly cared for pays for itself in ten years.

As an illustration of what is obtained from good bearing trees the writer gives the following example. The trees are all fifteen years old and of the following varieties: Mission 22, Manzanillo 249, Nevadillo 29, total 300.

Expenditure.

One team, cultivation, hauling, 50 days at $ 1	$	50
One man labour during year, cultivating, pruning, hauling, irrigating	»	120
Irrigation water $ 3 a year per acre	»	9
12 ½ lbs fertilizer a tree at 2 cents a lb.	»	75
Total	$	254

Receipts.

13 ½ tons pickle olives (picked by factory) at $ 100 per ton.	$	1 350
2 tons of oil olives (picked by factory) at $ 30 per ton	»	60
Total receipts	$	1 410
Total cost of production	»	254
Balance	$	1 156

In another case twenty-two acres of Mission olives, eight years old, planted on a steep, rocky hillside where very little cultivation or pruning is practised, produced 13 tons pickle olives at $ 150 a ton, whilst the total cost of production amounted to $ 374.

916 – **Tea Seed Oil.** — DEUSS, J. J. B., in *Mededeelingen van het Proefstation voor thee*, No. XXXIII. Buitenzorg, 1914.

The seeds of *Camellia* and *Thea* contain a considerable quantity of oil, and the oil from *C. oleifera* Abel has long been used in China. The present paper deals especially with the oil of seeds of *Thea assamica* J. W. Master and *T. sinensis* L. Attempts have been made to place the seeds on the London market, but without result. Experiments carried out on a small scale have shown that tea seeds can be successfully exported to London when carefully packed.

In 1901 an English planter drew the attention of the Indian Tea Association to the question of the oil in the seed. The oil used in China is obtained from *C. sasanqua* Thumb. (= *C. oleifera* Abel) and *C. drubifera* Lour. HEFTER, in his work *Technologie der Fette und Öle*, mentions several oil yielding species. Analysis of the seeds shows 50 per cent of water in the fresh material and 37 per cent of oil in the dry matter. According to HOOPER (*The Pharmaceutical Journal and Transactions*, 678, 1894; 605, 1895), tea seeds have the following composition in percentage of dry matter:

Oil	22.9	Other carbohydrates	19.9
Albumen	8.5	Fibre	3.8
Saponins	9.1	Mineral matter	3.3
Starch	32.5		

The present writer found 43 per cent of oil, obtained by extraction from the seeds dried at 100-105° C. The quantity of oil obtained is not increased by pressure and there is risk of obtaining saponins in the oil. When abso-

lutely clear the oil contains no saponin. If the seeds become dark brown on drying there is danger of the oil being darkened and difficult to purify. Otherwise it is of a golden yellow colour. In Java the natives prepare oil from tea seed by pressure, but this practice is no longer frequent. It is sometimes difficult to remove from the oil the last traces of liquid used in the extraction process, though in the industry this operation is not generally difficult.

The oils obtained from different species of tea are very similar; they are not drying oils and they possess an agreeable taste. They are used by the Chinese for culinary, medicinal and toilet purposes. They may also be used in the manufacture of soap and for lubricating purposes as they acidify with difficulty. In its analytical characteristics tea seed oil resembles olive oil and pea-nut oil.

The oil cake obtained after extraction of the oil has no great value. It contains only 1.92 per cent of nitrogen and is therefore of value as a manure only when it can be obtained without expensive transport.

Tea seeds are sold in Cochin China for oil extraction and the price of the oil is very low, about 2*s* 6*d* per gallon (1).

RUBBER, GUM AND RESIN PLANTS

917 - **Tapping and the Storage of Plant-Food in *Hevea brasiliensis*.** — CAMPBELL, L. E. (Rubber Research Chemist), in *Department of Agriculture, Ceylon, Bulletin* No. 16, pp. 1-26 + diags. 1-6. Colombo, March 1915.

In these experiments the effect of different systems of tapping on the vitality of the tree was estimated in terms of the depletion of starch reserves in the cortex and wood. Sections of the tapping areas were taken at different depths in the bark and wood and the amount of starch was determined by counting the number of starch granules visible in the microscopic field of a $^1/_6$th inch objective.

The following systems of tapping were examined :

1) Full herringbone, 3 cuts tapped every three days.

2) Heavy tapping an old tree (11 years) on the full herringbone system, changing from one side to the other every six or eight weeks.

3) Two cuts on one third circumference.

4) Single cut on each half of the tree, tapped on each side alternately every three months.

The results obtained are summarised as follows:

1) In all cases the food supply of the bark had not disappeared below the tapped area.

2) In the first system there was a partial removal of starch below the tapping cut to a depth of ½ inch and in the third and fourth systems to a depth of 1 ⅓ inch.

3) On the side of the tapped areas the removal of starch was less extensive.

4) Starch is only withdrawn from the wood immediately behind the cut.

(1) See *B.* January 1912, No. 115. (*Ed.*)

5) In the heavy tapping system over a number of years the starch content in the bark above the tapped area was lower than that of any other tree examined, though it was not seriously depleted.

From these results it is concluded that the effect of careful tapping is localised, the starch content of the bark being normal in the majority of cases right down to the beginning of the tapped area. In no case was the depth of the cuts within 1 mm. or $^1/_{25}$ inch from the cambium and since it is probable that food transport from the leaves takes place largely within this layer, normal tapping causes little interference with food supplies of the various parts of the tree. By changing the tapping from one side of the tree to another, as in the case of the second system above, the resting period of each area is nearly as effective as if the whole tree were rested. By adopting this method it is probable that the antagonism between high yields of rubber and good bark renewal may be overcome.

918 - **One of the Causes of the Differences in Quality of Hevea Rubber.** — GORTE, KR., in *Teysmannia*, Year XXVI, Part 1-2, pp. 82-85. Batavia, 1915.

The writer finds that the properties of *Hevea* rubber vary according to the tree from which the latex is obtained. This opinion is based on determinations of viscosity of rubber in solution in benzene. He established an index of viscosity and found important differences among the individual trees yielding the rubber. There also appears to be a correlation between the colour of the latex and the quality of the product. These observations are of importance in the selection of seed bearing trees.

919 - **The Distinguishing Characters of Sugar Cane in Bengal.** — WOODHOUSE, E. J. (Economic Botanist, Bihar and Orissa); BASU, S. U. (Assistant Professor, Agricultural College, Sabour) and TAYLOR, C. S. (Agricultural Chemist, Bihar and Orissa), in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 2, pp. 107-153, 3 plates. Calcutta, April 1915. SUGAR CROPS.

In experiments to determine the agriculturai, botanical and chemical characteristics of varieties of sugar cane it is necessary that pure line cultures should be used. For this purpose a collection of the principal varieties of cane in Bengal was made in 1908. These were planted in 1909 and at the end of the season mass selections of the best canes of each variety were made and planted to form plots of pure line cultures.

Observations have since been made with regard to the following characters :

FIELD CHARACTERS :

1. *Habit of growth:* erect, ascending or decumbent.
2. *Persistence of dry leaves and sheaths.*
3. *Tillering power.*
4. *General appearance of the cane* : straight or curved, thick or thin.
5. *Length:* from ground level to base of green sheath of highest joint.
6. *Number of internodes* : average of ten typical canes.
7. *Length of internodes:* average length of 10 internodes, 5 on each side of the middle node.

8. *Thickness of cane* : 3 measurements : *a*) diameter of tenth node from base ; *b*) diameter of the middle of the internode above the tenth node ; c) diameter of narrowest part of this internode.

9. *Shape of cane* : relation of the diameter of the node to that of the internode, and the shape of the internode, whether straight, tapering or barrel-shaped.

10. *Colour and markings of cane.*

11. *Development of aerial roots.*

12. *Wax* on the internodes and its colour effects.

13. *Colour band* immediately above the nodes.

14. *Buds* : size and shape, and amount of sprouting.

LEAF CHARACTERS :

1. *General appearance* : straight or bent.

2. *Size.*

3. *Colour.*

4. *Ligular band* : two patches of colour at the junction of the leaf blade and sheath.

BIOLOGICAL AND CHEMICAL CHARACTERS:

1. *Weight of* 100 *canes.*

2. *Flowering.*

3. *Diseases*: immunity or otherwise.

4. *Saccharose content*: some varieties showed no variation in this respect at different periods of growth. Dwarf canes generally show large increases with increasing maturity.

5. *Percentage of fibrous matter in cane.*

6. *Extraction factor.* This varies with the fibrous matter unless more suitable machinery is employed.

From a chemical point of view 4 different groups can be obtained which coincide with 4 botanical groups as follows :

1) Late ripening, medium fibre, low extraction factor corresponding with group I. — Short bushy canes completely covered by dry persistent leaves and sheaths, comparatively high tillers, straight canes, 30 internodes of average length 3 inches, colour honey yellow to sea green, wax thick all over the cane, rooting band inconspicuous, aerial roots typically absent, dormant buds stout and conical, colour band absent, leaves narrow with bend at the tip. Not given to flowering nor liable to attacks of red rot.

2) Early ripening, medium fibre, high extraction factor, corresponding with group II. — Short bushy canes similar to the above in appearance, length, thickness and colour of the canes, but with longer internodes (3-5 inches), wax scanty except at the wax band (1), aerial roots on lower nodes, distinct narrow colour band, leaves typically straight, shorter and arranged in a fanlike manner, liable to flower.

3) Early ripening, high fibre, high extraction factor, corresponding with group V. — Tall canes in spreading clumps, aerial roots well developed

(1) Situated just below the node.

high up on the stem, colour band broad and prominent, ligular band brownish; flowers frequently and very liable to attacks of smut disease.

4) Medium early ripening, medium fibre, high extraction factor, corresponding to group VI. — Tall spreading clumps, internodes 25 to 35, average length 4 to 5 inches, colour yellow green, difference in thickness between nodes and internodes is $^1/_{10}$ inch, rooting band prominent, tubercled and aerial roots confined to lowest 6 nodes, distinct colour band less marked than preceding.

The other botanical groups are: III. — Tall spreading or bent over to the ground, covered with dry persistent leaves, tillering lower than group I, internodes 3 to 4 inches, colour light yellow green, aerial roots low, colour band narrow, leaves upright, ligular band faintly reddish yellow.

IV. — Bushes tall upright or slightly spreading, length of internodes 3 to 4 inches, well marked difference in thickness between nodes and internodes, colour dirty yellow green, aerial roots high, colour band indistinct, leaves bent over, ligular band yellowish.

It is concluded therefore that the chemical and botanical characters of the varieties are closely allied. Observations from year to year show little difference in the order of extraction of each cane, which is probably a definite characteristic depending on some botanical character of the cane.

920 – **The Growth of the Stem, Leaf and Leaf-sheath of Sugar Cane.** — KUIJPER, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXIII, Part 13, pp. 528-556, 6 figs. Soerabaja, March 1915.

The writer describes a new method for measuring the growth of the hidden leaves and of the upper portion of the stem of the sugar cane. By inserting a needle horizontally in the growing region holes are made through all the leaves, sheaths and internodes, which will serve as points from which to measure the growth of the various parts with respect to the outer sheath which has ceased growth.

By removing the leaves one by one after a certain time the displacement of the holes in the different parts of the stem can be measured with respect to the small hole formed by the needle in the outer sheath. The writer discusses the 'pros' and 'cons' of this method and its possible errors. He then describes the structure of the meristem and of the surrounding parts as a method for indicating graphically the mode of growth.

From these determinations the writer concludes that the elongation of the sheath occurs later than the growth of the leaf; that the internode at the extremity of which the leaf occurs begins to elongate when the growth of the entire leaf has almost finished; that the growth is basipetal and there is a zone at the base of the internode which has not yet reached its maximum growth when the upper portions have already reached theirs.

These observations were verified by measuring the cells of the sheaths and of the internodes at various stages of growth. In the cells furthest from the base of the internode the growth first reaches its maximum. The growth of the stem was studied by making a long narrow opening in the enveloping sheaths and marking the stem with ink. The same results were obtained by the various methods.

The writer explains how this mode of growth of the exterior leaves may be the primary cause of the symptoms of the disease known in Java as "top rot" or "pokkah-bong", and characterised by the rotting of the young leaves or by a defective unfolding of the leaves.

921 – **The Experimental Error in Field Trials with Sugarcane and the Effect on this Error of Various Methods of Sampling.** — ANNETT, H. E. — *Agricultural Research Institute, Pusa, Bulletin* No. 49, 18 pp. Calcutta, 1915.

It has recently been shown by LEATHER (1) that the probable error in sampling sugar cane is very small if, on a plot one tenth of an acre in area about 200 canes be taken in lots of three from 70 equidistant points throughout the plot. A field of sugarcane being available for the purpose, the sampling experiments were repeated at the Dacca Experimental Farm, and by reduplicating the plots, it became possible to determine at the same time the experimental error due to the position of the plots.

Five varieties of sugarcane were grown in triplicate on 15 plots each of which was one tenth of an acre in area. The methods of sampling employed were as follows:

a) 50 canes were selected from equidistant points on the plots.
b) 100 » » » » » » »
c) 200 » » » in groups of three from 70 equidistant points on the plots
d) alternate rows were taken throughout each plot.
e) each plot was divided into two equal parts and each half was taken bodily.

On one and the same plot, *b* and *c* methods of sampling gave results fully as reliable as *d* and *e*, but the *a* method was somewhat less satisfactory. With regard to the experimental error due to soil factors, it was found that on the Dacca farm, owing to the great lack of uniformity of the soil, the variation due to position of the plot gave rise to far greater errors than the method of sampling.

922 – **The Influence of Phosphatic Manure on the Root System of Sugar-Beets in Russia.** — SAZANOFF, W., in *Journal Opitnoi Agronomii*, Vol. XVI, Part 2, pp. 140-165, 17 figs. Petrograd, 1915.

An exact idea of the conditions of nutrition and growth of a plant cannot be made without a knowledge of its root system. Hence for the rational study of the cultivation and manuring of different plants such a knowledge of the root system is indispensable in each case. The small amount of information available on this question led the writer to carry out researches at the Experiment Station of Soumy, Russia, to show the influence of phosphatic manures (superphosphate) on the growth of the root system in beets and other plants. The method employed was that of ROTMISTROFF, *viz.* cultures in narrow boxes, and removal of the plants by washing.

The results of the researches on the absorption of soluble phosphoric acid by the black chernoziom soil, show that a displacement of the soluble phos

(1) See *B.* Feb. 1914, No. 125. (*Ed.*).

phoric acid from one layer of chernoziom to another is impossible. The general conclusions are as follows :

1) The soluble phosphoric acid of a manure becomes fixed in the soil to which the phosphatic manure is applied and for this reason no appreciable displacement of the phosphoric acid from one layer to another was observed.

2) Superphosphate favours the excessive development of the rootlets of the beets and in consequence the strongest growth of the rootlets is observed particularly in the layer to which a phosphatic manure has been applied.

3) No similar action of superphosphate, of nitrate of soda or of sulphate of potash was observed in the root systems of either spring wheat, rye or winter wheat.

923 - **Distribution of Invertase in the Tissues of Beets at Different Periods of Growth.** — COLIN, H., in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 160, No. 24, pp. 777-779. Paris, June 14, 1915.

The distribution of invertase in the tissues of beets at different periods of growth is of interest in connection with the problem of the accumulation of sugar in the root and its migration towards the leaves.

As the result of experiments on the hydrolysis of sugar by means of extracts of the different parts of beets one and two years old, the following facts were obtained :

One year old beets.— 1) *Leaf-blade.*— The leaf-blade is always rich in invertase. When placed in contact with a solution of sugar, in either the fresh, dried or macerated condition a rapid conversion takes place. There is no relation between the amount of chlorophyll and the amount of invertase in the leaves. Young leaves as yet without chlorophyll and etiolated leaves grown in the dark are as rich in the ferment or even more so than green leaves.

2) *Petiole.* — The hydrolytic power of the petioles diminishes from the upper portion towards the base. It is appreciable near the leaf-blade but is almost nil near the neck of the root.

3) *Root.*— The root under normal conditions possesses no hydrolytic properties. This is equally true for the tissues of the neck as for the pulp in the centre of the root. It is only in the case of insufficient aeration that the root acquires the property of hydrolysing saccharose, and a large proportion of uncrystallisable sugar is then found.

Two conclusions follow from these facts :

a) If the root elaborates saccharose at the expense of the reduced sugar supplied by the leaves, this synthesis is not effected by an invertase similar to that occurring in the leaves.

b) Saccharose may only accumulate in the leaf-blade under conditions such that the rate of synthesis is greater than that of hydrolysis; otherwise the amount of saccharose would steadily diminish owing to the invertase apart from the translocation towards the root. These conditions occur in full sunlight.

Two year old beets. — 1) *Root.* — During the resting period carefully

stored roots show little increase in the percentage of reducing sugar, and sucrase appears to be absent. This condition continues during subsequent growth until the ripening of the seeds, and at no period is there any considerable hydrolysis of sugar resulting from an elaboration of invertase.

Thus the saccharose passes from the root to the stem without being converted, hydrolysis only taking place in the leaves.

2) *Stem.* — Invertase is present in all parts of the stem, though the hydrolitic power of the tissues increases towards the summit and is greatest in the inflorescence.

924 - **Researches on Four Strains of Sugar-Beets in Russia.** — BOLOTOFF, W., in *Journal Opitnoi Agronomii*, Vol. XVI, Part 2, pp. 106-117. Petrograd, 1915.

In former papers KOLKOUNOFF has shown that each variety of wheat and maize consists of a series of strains distinguishable according to the size of their cells, which is a fixed character for each line. He also showed that varieties of beets must also consist of strains having cells of different sizes and that the small-celled strains would be more productive in dry seasons and generally richer in sugar.

In order to verify this, the above writer studied during 1911, 50 specimens of beets of different origin and selected 4 plants for further work, *viz.* two with small cells and two with large cells. The roots of these plants were grown the following year, the two former being planted in the open and the two latter in an isolation house. The seeds of each plant were sown separately in the spring of 1913 ; all the strains except one of the small-celled strains succumbed to the attacks of *Cercospora beticola*. The results showed that : 1) the size of cell is hereditary in beets ; 2) beets with small cells contain a higher percentage of sugar than large-celled beets, confirming KOLKOUNOFF'S conclusions.

925 - **Studies on Sugar-Beets Left in the Ground until May.** — CROCHETELLE, J., in *Journal d'Agriculture Pratique*, Vol. 28, No. 51, pp. 472-474. Paris, July 15, 1915.

Advantage has been taken of the exceptional circumstances of the war to compare beets put in silos at the beginning of the sugar season with those remaining in the fields. From determinations of the average weight, the percentage of sugar and the saline coefficient of beets in January 1915 the writer concludes that roots remaining in the ground until the end of January do not live at the expense of their reserves and that the percentage of sugar does not diminish as much as in the case of beets collected early and stored in silos.

Similar determinations on beets uprooted on May 7 under still more abnormal conditions gave the following results:

Average weight of beets	1.39 lbs.
Density of juice	7°
Sugar by saccharimeter	16.02 %
Sugar by density	18.40 %
Coefficient of purity	87.50
Mineral matter in juice	0.72 %
Saline coefficient	24.70

The proportions of leaf and root from the physiological point of view are as follows:

		Roots	Leaves	Total	Ratio $\frac{\text{Leaves}}{\text{Roots}}$
		lbs.	lbs.	lbs.	
January.	Beets in the ground	19.140	0.99	20.13	5.17
	» » silos	20.98	1.02	22.00	4.85
May 7.	Beets newly dug up	10.802	3.828	14.630	35.00

The table of the composition of beets and leaves shows that the composition of the roots varies in the sense that the mineral matter as well as the nitrogenous matter occurs in greater proportion in beets in silos than in those remaining in the ground. During the three months of spring, nitrogenous as well as mineral matters have increased considerably in the leaves, whilst the total dry matter shows a slight increase. In the roots, on the contrary, during the same period there was a strong decrease in the total dry matter as well as in the percentage of sugar.

926 – **Drug Plants that are or may be Cultivated in the United States.** — STOCKBERGER, W. W. (Physiologist in Charge of Drug-plant and Poisonous-plant Investigations), in *U. S. Department of Agriculture, Farmer's Bulletin* No. 663, 39 pp., 8 figs. Washington, June 5, 1915.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

The following plants are cultivated in numerous places in the Central and Eastern States of the North American Union:

Anise (*Pimpinella anisum*)
Belladonna (*Atropa belladonna*)
Burdock (*Arctium lappa*)
Camomile (*Anthemis nobilis*)
Caraway (*Carum carvi*)
Catnip (*Nepeta cataria*)
Conium (*Conium maculatum*)
Coriander (*Coriandrum sativum*)
Digitalis (*Digitalis purpurea*)
Dill (*Anethum graveolens*)
Echinacea (*Brauneria angustifolia*)
Elecampane (*Inula helenium*)
Fennel (*Foeniculum vulgare*)
Henbane (*Hyosciamus niger*)
Horehound (*Marrubium vulgare*)
Penny Royal (*Hedeoma pulegioides*)
Sage (*Salvia officinalis*)
Stramonium (*Datura stramonium*)
Tansy (*Tanacetum vulgare*)
Thyme (*Thymus vulgaris*).

It is probable that the cultivation of these plants might be extended to many other places where the conditions of climate are the same as where they are now grown. Some plants, such as Aconite (*Aconitum napellus*), Arnica (*Arnica montana*), Lovage (*Levisticum officinale*), Poppy, Seneca (*Polygala senaga*), Valerian (*Valeriana officinalis*), Wormwood (*Artemisia absinthium*), seem to thrive better in the northern half of the United States, where the rainfall is more evenly distributed throughout the growing season. On the other hand Cannabis (*Cannabis sativa*), the female flowers of which are used in medicine, Liquorice (*Glycyrrhiza glabra*), Wormseed (*Chenopodium anthelminticum*) are better suited to the warmer climate of the southern

half of the United States. Aletris (*Alethris farinosa*), Althea (*Althaea officinalis*), Angelica (*Angelica officinalis*), Calamus (*Acorus calamus*), Orris (*Iris florentina*), Pinkroot (*Spigelia marilandica*), Peppermint (*Mentha piperita*), Serpentaria (*Aristolochia serpentaria*), Spearmint (*Mentha spicata = M. sylvestris*) generally thrive best in situations where the soil is rich and moist. Lavender (*Lavandula vera*), Larkspur (*Delphinium consolida*), which grows wild in several parts of the States, and *D. orceolatum = D. exaltatum* of indigenous growth, thrive best in well drained sandy soil. Ginseng (*Ranax quinquefolium = Aralia quinquefolia*), Hydrastis or Goldenseal (*Hydrastis canadensis*) grow wild in rich soil under shady trees or in woods, and can be successfully cultivated only if planted in woods or in soil specially prepared or artificially shaded.

The writer first treats in a general way of the cultivation, harvesting, preparation or trade of these plants, subsequently gives a detailed account of each one and concludes with a list of publications concerning drug-plants made by the United States Department of Agriculture.

927 – **Experiments on the Cultivation of the Opium Poppy in France.** — GILLET, E., and MILLAND, R., in *La Vie agricole et rurale*, Year 5, No. 8, pp. 151-152, 3 figs. Paris July 10, 1915.

One of the writers has grown opium poppies in a calcareous sandy soil near Paris, from seed obtained from Hadjikeny, Turkey. The seeds were sown towards the end of December or the first half of January in small hills 12 inches apart. After two thinnings in February-March and April-May one or two vigorous plants remained in each hill. The first flowers appeared towards the middle of June. The maximum height of the stems was 4 ½ feet, good average specimens reaching about 4 feet. Incisions were made towards the end of June by means of a small toothed knife as used in Anatolia and the collection of opium ended on July 6. From $^1/_{40}$ acre of land a ball of opium 1.6 inches in diameter was obtained. It was of excellent quality and yielded 13.94 per cent of morphine. For purposes of comparison the horticultural variety of the opium poppy was cultivated. Incisions made during the first fortnight of July, or 5 to 10 days after the fall of the petals, gave a very abundant yield of latex, and the opium contained 21.3 per cent of morphine.

Cultivation experiments have been made with opium poppies in France several times since 1807 and a superior product was always obtained. The high cost of production, however, has rendered this crop impossible in France, Belgium, Switzerland, Germany, England, Italy, as well as in Australia and America.

The writers conclude that the cultivation of this crop from a commercial point of view would not be a success in France even with improvements in the methods of collection.

FRUIT GROWING

928 – **Graft Hybrid Produced by Grafting Medlar on Hawthorn.** — MANAROSI, ANGELO, in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Parts 5-6-7, pp. 513-544, plates V-VIII. Modena, 1915.

The writer refers to the various graft hybrids previously recorded in the literature of the subject, particularly those of *Cratægus monogyna* and

Mespilus germanica known as *Crataegomespilus* spp. and describes a specimen observed in the province of Forli, Italy. The hawthorn stock measured 22 inches in circumference in August 1913 and the medlar graft was somewhat larger measuring 29 inches in circumference. At the swollen junction of the graft is a five year old branch 5 ft. 8 ins. long and 2 1/3 ins. in circumference. It is without thorns and bears leaves more resembling those of the hawthorn than of the medlar, flowers like those of the hawthorn but larger, and fruits globular to oval in shape, pedunculate, brown skinned, 11 to 12 mm. long by 10 to 11 mm. broad.

The maximum germinative power of the pollen of this graft hybrid was 42.9 per cent in a 15 per cent glucose solution at 15° C., and 53.3 per cent in a 20 per cent saccharose solution at 20° C.

A bibliography containing 22 references is appended.

929 – **Manuring Experiments with Citrus Seedlings in Sand Cultures.** — FLOYD B. F. (Plant Physiologist) in *Annual Report of the University of Florida Agricultural Experiment Station*, 1913, pp. XLIV-LI, + 2 plates. Tallahassee, Florida, 1914.

In order to obtain more accurate information on the value of various manures for citrus trees, pot culture experiments were carried out with pomelo seedlings grown in sand. Measurements of the length and breadth of the stem and length and breadth of the leaves were made during the season.

This preliminary report deals with the effect of ammonia and phosphoric acid from varying sources. The best growth was obtained with a combination of dried blood and acid phosphate. The addition of lime appeared to retard growth. Sulphate of ammonia and acid phosphate gave the poorest growth of any of the various combinations and showed an improvement when lime was added.

Basic slag was a better source of phosphate than superphosphate for use with ammonium sulphate and nitrate of potash but only second best with dried blood. Nitrate of soda and nitrate of potash were equal in their effects on growth.

30 – **Grafting of the Cork Oak on the Evergreen Oak in Italy.** — CUSMANO, G. (Agricultural Inspector of the Agricultural Penal Colonies) in *Nuovi Annali di Agricoltura Siciliana*, Year IV, Series VI, Part II, pp. 96-110. Palermo, 1915. FORESTRY

The botanical study of the cork and everygreen oaks suggested to the writer the possibility of grafting the one on the other. In 1913 attempts were made in Sardinia at Sarcidano (province of Cagliari) and at Mamone (province of Sassari) with bud and branch grafts of the cork oak on evergreen oaks about 3 feet high and 8 to 10 years old. The writer recommends bud grafting as providing longer shoots. The graft should be made on the trunk and not on the branches if a yield of good quality is to be obtained. The advantages to be obtained by this practice are: 1) doubling the period of production; an evergreen oak grafted with cork oak living for 300 years would yield 30 to 37 crops of bark, whilst an ungrafted cork oak living for 150 years generally gives 15 to 17 crops; 2) a finer and bigger yield; 3) an increase in the value of the evergreen forests; whilst at the present time

evergreen oak are normally cut down for charcoal burning, grafted trees would give a crop of cork, after 8 to 10 years, of about 110 lbs. at each cutting, which at 32/- per cwt. would be equivalent to from 3 to 4 shillings per tree per annum.

931 - **Some Observations on Mahogany.** — SNEPVANGERS, F. W., in *Tectona*, Year VIII Part 3, pp. 126-130. Batavia, March 1915.

Mahogany (*Swietenia mahagoni* L). appears to be destined to occupy a more important place in teak plantations. The wood is of equal value to teak and the tree appears to grow well in places where the latter succeeds with the advantage that it also thrives at higher altitudes.

The writer gives the results of some plantation experiments made by the Forestry Department of the Dutch East Indies. In 1879, when mahogany was first introduced into Java, a plantation was established in the centre of the island. These trees flowered for the first time in 1892 and 10 years later the trees had reached a height of 63 feet and a circumference of 1 ½ feet at breast-height. Another plantation made in 1903 in the eastern part of the island grew so well that it was added to during 1913-14.

During the dry season (eastern monsoon), the trees lose their leaves and generally new foliage appears in October when flowering begins.

LIVE STOCK AND BREEDING.

HYGIENE

932 - **On the Spread of Tuberculosis in Pigs by means of Unheated Separated Whey.** — BURRI, R. and GEILINGER, HANS, in *Landwirtschaftliches Jahrbuch der Schweiz*, Year 29 Part 2, pp. 314-325. Berne, 1915.

The old system obtaining in the cheese factories of Emmental of removing the fat residue from whey by acidifying and heating is now re

Quantity and condition of milk used in cheese making	Milk injected into guinea pigs	No. of pigs injected	Effect of injection
Mixture of 10 litres of healthy milk with 200 cc. of milk from a cow with mammary tuberculosis (dilution 1 in 50).	Milk before being made into cheese	2	Both animals developed tuberculosis.
	Separated whey	4	All four animals developed tuberculosis.
	Skimmed whey (old process)	2	Both animals remained well.
Mixture of 450 litres of healthy milk with 450 cc. of milk from a cow with mammary tuberculosis (dilution of infected milk 1 : 1000).	Milk before cheese making	1	Tuberculosis developed.
	Separated whey	5	All 5 animals became tuberculous.
	Skimmed whey (old process)	2	Both animals remained healthy.

placed by centrifugalisation. As the separated whey is mostly employed in feeding pigs, the writers carried out experiments to determine if whey separated by any process and infected with tuberculosis should be heated before being fed to pigs so as to avoid infection.

They performed injections (intraperitoneal and sub-cutaneous) with both healthy and infected separated whey on 52 guinea pigs. The results obtained are summarised in the accompanying table.

From the results the writers are led to the following conclusions. Heating the whey as practised under the old system for the separation of the cream is sufficient to kill the tubercular bacilli, whilst unheated skimmed or separated whey retains its infection. Such whey should therefore be heated before feeding to pigs. A temperature of 80° C. is considered sufficient for this purpose if produced by steam heat.

933 - **Observations on the Disease *Keratitis infectiosa* of the Reindeer.** — BERGMAN R. AVID, in *Deutsche Tierärztliche Wochenschrift*, Year 23, No. 28, pp. 226-229. Hanover, July 10, 1915.

The writer summarises his investigations into a disease of reindeer which has been found to be identical with *Keratitis infectiosa* of cattle. The pathological process originates in the centre of the cornea, a part in which nutrition is most defective. At first a destruction of tissue is noticed, after which an abscess, which does not tend to enlarge, is formed. At the close of the formation of the abscess, perforation of the cornea may take place.

The writer has observed that this disease attacks herds that come into contact with animals suffering from it. He concludes that it is infectious and that it spreads mainly by contact. The virulence of the pathogenic agent seems to increase and diminish according to circumstances.

The number of animals affected varies very much in the various herds. In 1909 the writer found 90 per cent of the calves of one herd attacked by the disease ; of these 20 per cent had both eyes affected ; 60 per cent of the affected animals recovered. In 1910, 8 per cent of the calves of a herd were attacked, and of these 2 per cent perished ; in 4 per cent the disease seemed to disappear, but the animals were all more or less blind. In another herd the disease was observed in 20 per cent of the animals, of which 8 per cent were blind in one eye ; 3 per cent died and the others recovered.

The writer tried to communicate the disease by rubbing the eyes of animals with liquid from the eye of an infected reindeer ; the result was negative with sheep. It must, however, be mentioned that in these experiments the liquid had, in all cases but one, been kept for eight days before being applied.

In the liquid from the eyes of infected animals numerous Gram-positive cocci were found. These cocci were often encircled by leucocytes and could be identified as belonging to the *Micrococcus candicans* group. In some of his investigations the writer found also colonies of *Bacillus subtilis*, *B. coli*, *Staphylococcum pyogenes*, etc. None of the bacteria proved pathogenic on being injected into the peritoneum of guinea-pigs, white mice, etc.

But this notwithstanding, the writer believes that *Micrococcus candicans* plays an important part in the origin of the disease.

Treating the affected animals at the beginning of the disease with a 1 per thousand solution of oxycyanide of mercury has given good results.

934 – **Anti-Hog-Cholera Serum in Cuba.** — DE CASTRO, RAFAEL (Chief of the Department of Epizootics, Central Experiment Station, Santiago de las Vegas) in *Modern Cuba Magazine, Cuba Moderna, Revista mensual*, Vol. 3 (7), No. 6, pp. 38-43, 2 Figs. Havana, June 1915.

Owing to the favourable conditions of soil and climate, Cuba is eminently suitable to the raising of hogs, but hitherto this industry has suffered much from hog cholera or "Pintadilla", which, according to the writer, exists in 90 per cent of the farms where hogs are raised and causes the death of 90 per cent of the animals attacked. The losses caused by this disease, especially in recent years, are estimated at more than $ 3 000 000 annually.

The Department of Agriculture has entrusted the Laboratory of Epizootics at the Central Experiment Station of Santiago de las Vegas with the preparation of the anti-cholera serum (1), which is distributed and applied gratis by the veterinary officials.

Hitherto some 5000 hogs have been vaccinated, with the simultaneous treatment by serum and virus, and the mortality has been reduced from 90 per cent among the non-vaccinated to 1.98 per cent among the vaccinated ones, and to 65 per cent of those that were vaccinated after being attacked by the disease.

At the beginning of the summer the mortality of hogs decreases. It seems that under the conditions prevailing in Cuba the virulence increases at the beginning of winter, consequently the best time to vaccinate is during the summer months.

The immunity that is conferred by injecting serum and virus, that is, the simultaneous treatment, is permanent, while that obtained with the single treatment, namely the injection of serum alone, is transitory, lasting at most eight weeks.

The immunity in itself is not transmitted from the mother to the offspring. However, the offspring of an immune mother may have a certain degree of immunity or resistance againts the disease while the suckling period lasts.

FEEDS AND FEEDING

935 – **The Action of Takadiastase on the Digestive Power of the Healthy Animal.** — SAWAMURA, S., in *Journal of the College of Agriculture, Imperial University of Tokyo*, Vol. V, No. 3, pp. 271-281. Tokyo, March 1, 1915.

Feeding trials were carried out with two Merino sheep to determine whether the administration of takadiastase in the diet had the effect of stimulating digestion. It was found that a very small dose of the enzyme (0.5 gm. per head per day) had no effect on the digestion, but when the dose was doubled, the digestion of starch was a little accelerated and that of

(1) See *B.* Oct. 1914, No. 920. (*Ed.*).

protein was also increased. The increased digestibility, however, was not large enough to justify the expense incurred by feeding the enzyme.

936 - **Researches on the Effects of Feeding the Proteins of Maize, Wheat and Eggs.** — BAGLIONI, S. in *Atti della Reale Accademia dei Lincei*, Series V, Vol. XXIV, Part II, pp. 1158-1163. Rome, June 24, 1915.

This is the seventh note on feeding experiments of the physiological laboratory of the University of Rome. As in the previous experiments white rats were used. The object of the investigations was to determine if the differences previously noted between the nutritive value of zein, gliadin, and egg albumin were specific for these proteins or if they extended to the other constituents of the grains from which they are obtained.

In the first series of experiments adult rats were fed for six weeks on a mixture of maize meal and wheat meal previously dried at 100° C., or on egg powder (the white and yolk being uniformly mixed and dried at 100°C.) to which was added known quantities of pork fat, cellulose (filter paper) and carbohydrates. From these experiments it appeared that maize meal as well as wheat meal and egg powder are able not only to maintain equilibrium, but also to effect distinct retention of nitrogen in the body. The whole of the nitrogen absorbed is not retained in the body as proteins some of it being lost in other ways than by excretion by the kidneys. For example, during the last three weeks the animal was continually losing hair. The body weight steadily diminished throughout and especially during the two weeks feeding on a maize diet. The loss was much less during the first week on the wheat diet and increased slightly during the second week. During the first week on egg diet the body weight increased considerably but diminished during the second week, probably owing to the insufficient quantity of food ingested and the smaller percentage of egg albumen supplied. It increased again slightly during the third week.

In a second series 7 adult and 4 young rats of both sexes were fed during several weeks on a diet of egg powder, maize meal or wheat meal supplemented by common salt and cellulose. The results as a whole were as follows : with egg powder there was a considerable increase in live weight, with the other foods sometimes a slight increase and sometimes a slight decrease in weight occurred.

Thus, in both series of experiments the inferiority in the nutritive value of zein and gliadin compared with that of egg albumin also appears when these proteins are fed in the form of maize meal, wheat meal and egg powder. There is however some difference in behaviour since the nutritive value of the zein or gliadin alone is relatively less than that of the complete meals. This may be attributed to the fact that other proteins of a higher nutritive value occur in the grains.

937 - **Stock Watering Places on Western Grazing Lands.** — BARNES, WILL C. (Inspector of Grazing) in *U. S. Department of Agriculture, Farmers' Bulletin* No. 592. pp. 27, 3 figs. Washington, 1914.

The suggestions given in this bulletin for improving the water supply in grazing areas in the West are the result of the experience of the Forest

Service in adding to or developing the water supply upon grazing area in the National Forests.

After a discussion of the daily water requirements of live-stock, of th relation of water supply to food production, of the temperature of the wa ter, which should not be too cold, and of the distance range-stock has t travel to water, which on average ranges should not be more than 2 miles under the most favourable conditions not more than 4 miles and i extremely rough mountainous country about half a mile, the writer treat the following points: Natural watering places and their improvement, cons truction and improvement of watering places (reservoirs, wells, pumps an windmills, troughs, seeps, water from mining tunnels, construction o troughs, use of cement for watering places etc.

In all a total of 676 separate water improvement project have been developed within the National Forests ; 329 by the users of th range themselves, 172 through cooperation between the Service and th users and 175 by the Forest Service alone. Of these improvements 378 ar springs or seeps, 286 are reservoirs or tanks, while the rest are wells, trail and the like.

The first point to be considered in developing the water resources o grazing areas is the amount of water necessary for individual animal of each class to be grazed. Unfortunately, no records have been kept nor stu dies made of the requirements of stock grazing on the open range. Howeve it is known what amount of water is consumed by stock under ordinar farm conditions. Observations of the amount of water consumed by horse under varying conditions of work and weather indicate a daily consump tion of between 50 and 110 pounds. A pair of mules at the Oklahoma Stat Experiment Station drank, during hot weather 113 pounds per head daily while one day they drank 175 pounds each (Farmers' Bulletin 170). I Germany a full-grown ox placed in a respiration chamber drank 123. pounds of water in 24 hours. At the Pennsylvania State Experiment Sta tion cows fed fresh grass consumed 60 pounds each per day, while other fed dry grass drank 107 pounds per day. The New York State Experi ment Station found that dry cows drank only 65 per cent as much as cow giving milk. Sheep on feed in Colorado consumed approximately 5 pound of water per head per day. In Michigan, on almost the same class of feed grain and hay, sheep consumed from 1.4 to 2.8 pounds of water per day Prof. HENRY says: «A sheep needs from 1 to 6 quarts of water daily, accord ing to feed and weather ». Forest officers estimate the average daily de mand for water by the several classes of stock using National Forest ran ges to be from 8 to 10 gallons for cattle and from 0.5 to 2 gallons for sheep In providing for a water supply for the different classes of stock, it wi be fairly safe to estimate, therefore, not less than 10 gallons per head pe day for cattle and horses and 1 ½ gallons per day per sheep.

When the food is very fresh and the morning dews are heavy, th herd will often go for comparatively long periods without needing wate other than that secured from their food. Under such conditions herde in the high mountain meadows usually do not take their herds to wate

more often than once in every 8 or 10 days if the supply is some distance away.

938 - **Towards a Greater Use of Rice Husks.** — MARCARELLI, BALDO, in *Il Giornale di Risicoltura*, Year V, No. 12, pp. 201-204. Vercelli, June 30, 1915.

The writer urges a more extensive use of the husks and chaff which are rich in nutritive substances and compares them with the husk of dried oats as follows:

	Rice husks	Oat husks
Moisture	13.00	12.00
Ash	7.40	—
Protein, crude (2 per cent N.)	12.50	10.40
Fat, crude	15.40	5.20
Fibre	10.20	57.80
N. free extract	41.50	

In the double purpose of forage and economising in the cost of the rations the writer draws the attention of breeders to this substance which is of great value in feeding draught horses. To prevent the loss of nutritive power the rice offal must be well stored. The quality of the product can be determined by the degree of acidity and its organoleptic qualities which might form the basis of a commercial classification of the product.

939 - **Feeding Experiments on Horses with Sugar and Meat-meal.** — GREVE, L. in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 26, pp. 301-303. Berlin, July 1, 1915.

These experiments were carried out to determine the value of a mixture of meat meal and sugar as a substitute for oats in feeding horses. The mixture used consisted of sugar denatured with beet pulp and meal containing 51 per cent of digestible protein and 2.83 per cent of crude fat. One kilo of oats in the diet was replaced by 1 kg. of sugar and 150 gms. of meat meal.

Three lots of 5 horses were fed on the following rations:

Group I. — hay and oats: Groups II and III. — hay, sugar and meat meal. The sugar and meat meal were given gradually in small quantities and only after a certain time were the oats entirely replaced by these substitutes. Once the animals became accustomed to the new diet they accepted it readily. Their coats remained glossy and fine, digestion was normal and their working capacity was not impaired. The weights of 12 of the horses increased during the period of the experiment.

It is concluded that:

1) A daily ration composed of 14.2 lbs. of sugar and up to 2 lbs. of meat meal may be fed without danger for a certain period.

2) Horses generally become readily accustomed to this ration.

3) The ration should be increased by concentrated foods when the horses are put to heavy work.

CATTLE

940 - **Cattle Breeding in the Dutch East Indies.** — VRIJBURG, B. in *Veeartsenijkundige Bladen voor Nederlandsch-Indië*, Year XXVII, Part 1, pp. 7-43. Batavia, 1915.

The writer studies the position of native cattle breeding in the economy of the Dutch Indies, the more technical aspects having been dealt with by experts. The owners of cattle belong exclusively to the native population which in Java and Madura obtain its chief means of subsistence from agriculture. Since the cattle are only used for the purposes of cultivation, breeding is reduced only to a non-productive accessory branch. This is confirmed by figures which show that the fertile lands under crops are more remunerative than cattle breeding.

The native cattle are of small proportions, not very early in development and of low fertility. Owing to this latter factor, in spite of measures taken to improve the race they can only realise a small value, the more so since in tropical countries the milk yield is always less than in subtropical and temperate regions.

If the land is to produce sufficient food for an ever increasing population it will be necessary to improve more and more the methods of cultivation. This can only be done by a more intensive cattle breeding and the introduction of a stronger race and better feeding practice so as to obtain at the same time both a better working animal and richer manure.

941 - **Colombian Cattle in Need of a Market.** — MANNING, J. A. (U. S. Consul, Barranquilla). *Supplement to Commerce Report, Annual Series*, No 42 *a*, Colombia. pp. 4-5. Washington, D. C., June 30, 1915.

From 1900 to 1908 Colombia shipped many cargoes of cattle on the hoof to restock the destroyed cattle farms and stock of Cuba, and until 1910 to Panama for consumption by the canal employees and to restock the pastures of that Republic. Since those dates, however, these two Republics have been able to supply the home demand from their own surplus. The result has been the partial abandonment of many of the cattle ranches and pastures near the Colombian coast, and the stock has been sacrificed for want of a profitable market.

The removal of the duty on live cattle in the United States in 1913, however, reanimated the Colombian cattle industry, and care has since been taken to augment the herds. In place of a duty, however, Colombian cattle growers find themselves confronted with a closed market in the United States because of a " suspicion quarantine " against Colombian cattle.

Colombian cattlemen would be able to ship several thousand head of fat cattle to American markets.

So far as the writer could learn, there is no disease among Colombian cattle, and fat cattle do not carry the cattle tick or " garapata ". These can be purchased now at 4 to 5 cents per pound on the hoof, and the steers will weigh 700 to 750 pounds at 4 years, but are light-boned and good beeves. It is said that the average loss of weight in shipping to Cuba would be about 8 per cent, principally in fat or tallow.

942 – **Raising Pigs on Pasture with Supplementary Ration of Grain. Experiments in the United States** (1). I. MORGAN, H. T. Cheap Pork from Pasture Crops, *The Country Gentleman*, Vol. LXXX, No. 19, pp. 341-842 and 860; Philadelphia, May 8, 1912. II. ASHBY, R. C. Grain for Pigs on Pasture, *ibid*, No. 22, p. 946 ; May 29, 1915. PIGS

The increased price of grains necessitates a partial substitution of pasture in the breeding of pigs. The choice of grain to be fed in combination with pasture or forage depends on the nature of the pasture it supplements ; when the forage is a legume, such as alfalfa, clover, soy beans or cow peas, maize is perhaps the most economical cereal to use ; but when the pasture is blue grass, sorghum, oats, rye or rape, the ration should contain besides the maize some other high-protein feeds, such as oil meal, or meat meal. etc.

Experiments made at the Missouri Agricultural Experiment Station have proved that the amount of grain to be given is possibly of even greater importance than the kind of grain given for determining the economy of gains. Experiments conducted at different North American Experiment Stations have shown that even the best forage crops afford little more than a maintenance ration for pigs, and that to obtain an increase of live-weight it is necessary to supplement with grain. Experiments show that the greatest economy in the cost of production is obtained by giving daily from 1 ½ to 2 lbs. of maize for every 100 lbs. live-weight. As a general rule, a quantity of grain should be given sufficient to produce a daily increase of 1 lb. for every 100 lbs. of live weight.

Where alfalfa is easy to grow, there is no better forage for pigs. At the Missouri Agricultural Station, the following results were obtained in feeding pigs with alfalfa amd maize. One acre of alfalfa will feed during the grazing season from 25 to 50 growing pigs. The important point to observe is not to pasture too closely. The best results are obtained by pasturing so as to have two cuttings of hay during the season besides what is foraged by the pigs. One acre of alfalfa pastured 12 head for 168 days. The amount of grain fed amounted to half a full ration, and it required 3,07 lbs. of grain to produce 1 lb. increase of live-weight ; while with a ration of maize alone, the quantity required was 5 or 6 lbs. The increase of live-weight due to the forage was 597 lbs., which gave a return of $35,82, to which the value of two light hay cuts must be added.

At the Iowa Experiment Station alfalfa was pastured for 201 days, from May 7th to November 25th, and gave the cheapest gains ever secured by any forage.

In 1911 in conjunction with a ration of maize cobs + $^1/_{20}$ meat meal and swill, alfalfa gave live-weight increase, when the price of maize was 50 cents per bushel, at a cost of $2.88 per 100 lbs.

Red clover ranks next to alfalfa as an excellent forage, provided it is not allowed to go to seed ; conditions may be kept right by pasturing the proper number of hogs. Red clover will not support so many pigs to the acre as alfalfa, nor does it furnish forage for so long a period. In two trials

(1) See also: *B.* Feb. 1912, No. 374; *B.* March 1912, No. 534; *B.* Dec. 1912, No. 1658 and 1659; *B.* June 1913 No. 717 ; *B.* Dec 1914, No. 1153. (*Ed.*)

TABLES I. — *Pasture and Forage for pigs.*

For foraging during	Crops that may be used	Time of sowing	Number of pigs per acre
April, May	Alfalfa	A previous year	8–15
	Rye	Preceding autumn	7–12
	Oats	March	6–10
	Rape	As early as ground can be worked	15–25
	Clover	Preceding season	6–10
	Blue grass	Preceding season or permanent	8–12
June, July	Alfalfa	A previous year	8–15
	Oats	March or April	6–10
	Peas and Oats	As early as ground can be worked	12–20
	Sorghum	April or May	20–30
	Rape	Early spring	15–25
	Blue grass	Permanent	8–12
August, September	Sorghum	April or May	20–30
	Soy beans	May	12–15
	Alfalfa	A previous year	6–10
	Maize	Early planting for hogging down	10–25
	Clover	Early spring or previous autumn	8–10
	Blue grass	Permanent	5–8
October, November	Alfalfa	A previous year	8–15
	Rye	September 1st	8–12
	Wheat	September 15th	6–8
	Rape	March to July	15–25
	Clover	April to May — second crop	6 10
	Pumpkinis	At maize planting time	10–20
	Blue grass	Permanent	8–12
December January February, March.	Both rye and wheat are sometimes available. *Blue grass* if not too closely pastured in spring.		

at the Missouri Agricultural Station one acre pastured 11 head for 130 days, and the amount of grain required for 1 lb. increase in live-weight was 2.97 lbs. (as a supplementary ration). In this case 572 lbs. of pork worth $34.32 were credited to the forage. The Iowa Experiment Station considers clover pasture one of the best rations available for fattening pigs on a full feed of maize.

Crimson clover sown in August and September gives abundant forage during the winter months and is largely grown along the Atlantic Coast.

Rape may be considered to rank next to clover. It should not be

pastured until it is from 12 to 15 inches high. With a moderate maize supplement one acre will feed 15 to 20 pigs. Experiments at various stations in North America give rape a feeding value of about $ 20 per acre. At the Missouri Station, 1 acre of rape and oats pastured 10 pigs for 107 days. For each pound increase of live-weight 3.28 lbs. of maize were required, and the pork accredited to forage was 380,7 lbs. — a return of $ 22.84 per acre. Throughout the greater portion of the Eastern and Middle-Western States, blue grass is well established and makes an excellent pasture for pigs if mixed with a plentiful amount of white clover. When permanent pasture is not available a good plan is to sow a field with a mixture of grains. The writer recommends a mixture of oats, barley and spring wheat, in equal proportions, to which timothy and clover may be added. Also field peas drilled in April or early May, at a depth of at least 3 inches ; with these, a week later, oats may be sown broadcast and lightly harrowed. When the pods begin to turn yellow, the oats will be in the " dough " stage, and both crops will be ready for foraging at the same time.

Table I has been compiled from State and Federal reports and is based on the experience and observations of the writer. The average weight of the pigs in this table is from 90-150 lbs. ; pigs of a higher weight will consume a relatively smaller quantity of forage than will younger animals.

A solution of the problem of finding a combination of forage and maize feed to give the maximum of economy in pig-feeding is offered by the following results of experiments made at the Nebraska Agricultural Experiment Station (*Bulletin* 121). Pigs born in the spring and pastured on alfalfa were given supplementary rations of maize in varying proportions. The experiment was begun on July 25th and continued during 119 days, 30 with pigs in each group.

TABLE II. — *Results of pasturing pigs on lucerne and maize.*

	Group 22	Group 23	Group 24
	lbs.	lbs.	lbs.
Maize per 100 lbs. live weight	1.0	2.0	3.0
Average final weight per pig	101.0	120.0	171.0
» initial » » »	42.0	42.0	42.0
Daily increase of weight » »	0.5	0.65	1.08
Grain per 100 lbs increase of live weight .	132.0	220.0	336.0
Cost of forage per 100 lbs increase of live weight	$ 1.05	$ 0.63	$ 0,28
Total cost per 100 lbs. increase of iive weight.	$ 2.16	$ 2.48	$ 3.10
Total profit per pig	$ 2.142	$ 2.499	$ 3,57

In establishing the prices given in Table II, maize was valued at $ 16.78 per ton, and the alfalfa forage at $^5/_{10}$ of a cent per head daily in group 22, at $^4/_{10}$ of a cent in group 23, and at $^3/_{10}$ of a cent, in group 24. This difference in the cost of alfalfa for the different lots was based on the amount of pasture consumed by each lot. The cost of the increase in live-weight covers the cost of feed and of all the ordinary risks, but does not include labour, equipment, or interest on the investment. The pigs were valued at $ 5.90 a hundredweight on foot . As shown by Table II the cost of production per unit of live-weight augmented with the increase of the maize ration, but as the development of the animals was correspondingly more rapid, the largest maize ration gave the biggest profits. The result is the same even when the price of maize is calculated at $ 23.20 the ton.

A similar experiment made under different conditions gave strikingly similar results. The writer fed different rations of grain to pigs born in the spring running on an excellent crop of oats and field peas. The supplementary ration consisted of barley, wheat, and a little meat meal and the trial lasted 28 days. The supplementary ration was valued at $ 30 a ton, and the live-weight increase at 8 cents a lb. — The gross return per acre of oats and peas is obtained by subtracting the value of the supplementary ration from that of the increase in live-weight but without deducting the cost of growing the crop.

TABLE III. — *Results of pasturing pigs on oats and peas with supplementary ration of barley and wheat.*

	Group 2	Group 1	Group 4
	lbs.	lbs.	lbs.
Supplementary ration: lbs. per cent. of live weight	1,0	2,0	3,0
Average final weight per pig	91,2	110,6	84,0
» initial » » »	72,6	87,6	55,7
» daily increase of weight per pig	0,7	0,8	1,0
» total increase per pig	19,6	22,4	28,0
Gross return per acre deducting cost of grain	$ 28,00	$ 33,06	$ 46,41

Since the liberal use of grain has proved profitable with alfalfa, it should prove more profitable still with pasture crops of less value. Frequently it may pay to feed grain where pigs are foraging off crops such as field peas, soy beans and even small grains.

943 – **Studies on the Physiology of Reproduction in the Domestic Fowl. X. Further data on Somatic and Genetic Sterility.** — CURTIX, MAYNIE R. and PEARL, RAYMOND (Biological Laboratory of the Maine Agricultural Experiment Station), in *The Journal of Experimental Zoology*, Vol. 19, No. 1, pp. 45-59. Philadelphia, Pa. July 5, 1915. POULTRY

Some time ago PEARL called attention to the fact that any single record of non-production or low production could not be accepted as evidence for the absence of the genetic factor for high production, since the failure of a bird to lay might be due entirely to somatic (physiological) causes. Later the writers published a description of two such cases. In both of these instances ovarian eggs were formed but did not enter the oviduct, being ovulated into the body cavity and resorbed without causing any apparent disturbance in metabolism.

Other cases of the same general nature are recorded in the present paper; the results are summarised as follows:

1. Birds which are hereditarily high layers may fail to make good performance records because for some anatomical reason it is impossible for yolks to enter the eviduct.

2. Birds which ovulate, or return partly formed eggs, into the body cavity usually show the nesting instict.

3. The nesting records show a rhythm similar to egg records of normal birds and it seems probable that they are the normal resultant of the ovulation.

4. Data given in this paper also confirm the following statements made in a recent paper by the same writers:

a) In case of stoppage of the duct at any level, the duct on both sides of the point of stoppage passes through the same cyclic changes, coordinated with the cyclic changes in the ovary, as a normal unobstructed duct. The duct functions only as far as it receives the stimulus of the advancing egg.

b) Absence of pressure from the funnel does not prevent or apparently greatly retard ovulation. Increased internal pressure may therefore be the most important factor in normal ovulation.

c) Yolks of partly or fully formed eggs may be absorbed rapidly and in large numbers from the peritoneal surface without causing any serious derangement of normal metabolic processes.

944 – **"Intensive" and "Semi-intensive" Systems of Poultry Keeping**, in *The Agricultural Gazette of New South Wales*, Vol. XXVI, No. 5. pp. 428-429. Sydney, May 1915.

In connection with an egg-laying competition held at Hawkesbury Agricultural College, a special trial was carried out to compare the value of the "intensive" and "semi-intensive" systems of poultry keeping. In both cases, the test pens consisted of 100 White Leghorn pullets, but while those kept on the intensive system were strictly confined to the poultry house (30 ft. × 17 ft. in size), those kept on the semi-intensive system were allowed in addition the run of a well-grassed yard 22 000 sq. ft. in area. The results of the experiment were clearly against the close confinement of the birds, the average egg yield in the semi-intensive pen being 168,5 eggs per hen during the twelve months' competition, while that in the intensive

pen was only 140 eggs. The death rate in both pens was very high, amounting to 12 in the intensive pen and 10 in the semi-intensive pen.

945 - **Report on the Fourth Egg-Laying Competition at Burnley, Victoria, Australia, from 1st April 1914 to 31st March 1915.** — HART, A. (Chief Poultry Expert) in *The Journal of the Department of Agriculture of Victoria*, Vol. XIII, Part 6, pp. 321-339, 13 Figs. Melbourne, 10 June 1915.

Egg laying competitions were first instituted in Victoria in 1904-1905, at Dookie Agricultural College. The first test was won by six White Leghorns, which produced in one year 1313 eggs. The second test (1905-1906) was won by six Silver-Wyandottes, with 1296 eggs; the fourth (1907-1908) by White Leghorns, producing 1314 eggs. The first competition held at Burnley in 1911-1912 was again won by six White Leghorns which laid in one year 1566 eggs; this particular test was open to all breeds, and Black Orpingtons, Silver Wyandottes, Minorcas, Faverolles, White Wyandottes, and Golden Wyandottes were also entered; the White Leghorns, however winning by a big majority. Of the other breeds, Black Orpingtons, put up the best results, producing 1240 eggs in the 12 months. In the 1912-1913 competition all breeds competed together, and all money prizes were won by White Leghorns, the winning score being 1468 eggs, and the second, 1454. In this test, the Black Orpingtons scored over the other heavy breeds, the six birds producing 1245 eggs. — The 1913-1914 competition was again a victory for the White Leghorns, the winning group produced 1667 eggs, that is, an average of 277 per bird for the year. The 63 pens of six birds each averaged over 212 eggs per bird; which may be classed as a really good result.

In the competition of 1914-1915 four classes were provided, 2 for light breeds, and 2 for heavy breeds (table birds); in each of these subdivisions 1 class was fed on dry mash, and the other on wet mash. This was done with the object of giving comparative data as to the merits of the various methods of feeding and also to encourage the raising of heavy breeds, which, though not such good egg producers as the White Leghorns (light breed) have greater merits as table birds.

The results of the competition were very satisfactory, and proved conclusively that excellent results may be obtained even with dry food, since the winning group, that produced 1699 eggs, that is 283 per bird in one year, was fed on dry mash, and all the White Leghorns similarly fed produced in one year an average of upwards of 50 eggs per group of 6 birds more than those fed on wet mash. The wet mash consisted of 5 parts of pollard, 4 of bran, 2 of minced liver, 1 of ground oats, 1 of peameal, 1 of oatmeal pollard, mixed with liver soup and given warm in a crumbly condition. Each bird received about 2 ozs. in the morning and 1 oz. at midday, mixed with green stuff consisting of chaffed green lucerne and silver beet. In the evening each group of 6 birds received from 11 ozs. to 13 ozs. of grain. Once a week cut onions were given as a tonic. The formula of dry mash was as follows: Bran 54 ½ lbs.; wheaten pollard 53 ½ lbs., lucerne pollard 14 lbs.; peameal 22 lbs.; oatmeal pollard 11 lbs.; ground oats (with portion of hulls removed) 19 ½ lbs.; dry molasses 1 ½ lbs.; cooked minced liver about 3 ozs. to each group of

six birds at 8. a. m. One ounce of salt was allowed for every 100 birds, mixed with the liver. The quantity of dry mash used per day for a pen of six birds, light breeds, is 12 ozs. including minced liver. Fresh-cut lucerne and silver beet are fed liberally at midday. The food was given at regular hours.

The following are some of the chief results:

The first 10 groups (light breeds) fed on wet mash produced on the average 1527 eggs per group of 6 birds. The average number of eggs per bird (on 588 birds) during the whole competition was 207.

The total number of eggs laid by 588 birds in one ear was 121 804; the price obtained at 1*s.* 2*d.* the dozen was £592 2s. 1d.

The number of eggs laid by the 1st, 2nd and 3rd pens in each of the sections, was:

	Pen 1	Pen 2	Pen 3
Light breeds, fed on wet mash	1633	1593	1587
» » » dry mash	1699	1514	1395
Heavy breeds fed on wet mash	1562	1439	1373
» » » dry mash	1210	1178	1168

The two winning pens for the greatest total number of eggs laid by a pen during the first four months of the competition (winter test) were:

	Pen 1	Pen 2
Light breeds: White Leghorns	565	533
Heavy breeds; Black Orpingtons	502	494

The maximum average weight of the eggs of one group was 2.131 oz.

Some of the above numbers are world records. The highest number of eggs hitherto laid in one year by a group of six birds, in Government competitions was:

For South Australia	1589	(White Leghorns)
» Western Australia	1564	
» New South Wales	1541	
» Queensland	1564	
» Victoria	1667	(Highest record previously)
» New Zealand	1632	

946 - **Winter Egg Records in Ireland.** — *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XV, No. 3, pp. 592-597. Dublin, April 1915.

The following data refer to records kept in Ireland under the supervision of the Department of Agriculture and Technical Instruction for Ireland, from 1st October 1914 to 31st March 1915. Similar observations were made during six previous winter seasons (1). Considering only the breeds of which more than 100 birds had been under observation, the best results were obtained with White Leghorns, Rhode Island Reds, Mixed Breeds, White Wyandottes, Light Sussex, Plymouth Rocks, and Faverolles. The

(1) See *B.* Oct. 1914, No. 932. (*Ed.*)

numbers in Table II afford additional evidence as to the great variations in results due to strain, and emphasise the importance of this latter factor.

TABLE I. — *Average number of eggs per bird from October 1914 to March 1915.*

White Leghorns	49.5
Minorcas	45.9
Buff Orpingtons	42.8
White »	35.4
White Wyandottes	35.8
Faverolles	28.7
Plymouth Rocks	32.9
Houdans	51.8
Rhode Island Reds	45.9
Light Sussex	33.6
Red »	28.5
Mixed Breeds	41.9
General average	40.5

TABLE II. — *Variations in results with different strains.*

Name of Breed	Average of all the flocks	Average of best flock	Average of worst flock
White Leghorn	49.5	83.7	30.7
» Wyandotte	35.8	45.8	31.7
Faverolle	28.7	37.6	19.9
Plymouth Rock	32.9	55.2	15.5
Rhode Island Red	45.9	64.9	22.3
Light Sussex	33.6	54.6	22.3
Mixed Breed	41.9	73.7	12.7

BEES

947 - **The Yield of Wax from Wild Bees in the East Indies.** — FISCHER, HANS, in *Zeitschrift für angewandte Chemie*, Year 28, No. 52, pp. 303-304. Leipzig, June 29, 1915.

Ghedda wax in the East Indies is obtained from wild bees belonging to the species *Apis dorsata, A. florea, A. indica* and also to the genera *Trigonea* and *Meliponea*.

In spite of the vast tracts of the East Indies and the little developed means of communication the wax is collected in almost identical manner in all the countries inhabited by the Djangel tribes. The trees sheltering the hives are smoked to drive away the bees and the honeycombs removed. Those occurring amongst rocks are obtained by working from a rope. In the regions where there are no beasts of prey the collection is done during the night.

The combs may vary in size from a hand's span to a diameter of 5 feet.

It is almost a universal practice to melt the comb after removal of

the honey. The boiling wax is filtered through a cloth and poured into a vessel containing cold water.

In some countries special methods are used for purifying and clarifying the wax. In the central provinces it is mixed with the solid excrement of cows and allowed to stand overnight when it is washed, melted and filtered through a cloth. This method gives a very clear wax. In other districts, as in Madras, the melted wax is mixed with leaves of tamarind a process which is said by the natives to clarify it. Sometimes chemical products are also added, *e. g.* common salt, borax, etc.

In all parts of India the purified wax is added to the powdered roots of *Curcuma longa* to give it a yellow colour. Its natural colour is either greyish or whitish green or yellowish grey.

The acidity of the Indian wax does not correspond to that of European wax. It would be possible, however, to mix the two products so as to obtain a wax with a degree of acidity of 16.6, an ether value of 78.74, a saponification value of 95.3, and an iodine value of 6.08.

948 - **Researches on the Coefficient of Osmotic Pressure in Silk-Worms during their Development.** — POLIMANTI, OSW. in *Biochemiche Zeitschrift*, Vol. 70, No. 1-2, pp. 74-92. Berlin, July 12, 1915. SILKWORMS

No previous experiments have been made to determine the coefficient of osmotic pressure in silk worms. For this purpose the writer used *Bombyx Mori* L. The eggs, larvae, chrysalids and adults were reduced to a pulp and the osmotic pressure determined by means of the BURIAN-DRUCKER apparatus.

It was generally found that the coefficient diminished with the age of the larvae. This phenomenon did not occur in all stages; during the first four periods the osmotic pressure diminished regularly, whilst in the fifth period it increased considerably. The decrease during the first four periods is due to the fact that the worm always eats less (relative to its weight) as it becomes older and the growth of its tissues diminishes. The increase during the fifth period on the contrary is due to the formation of silk glands and to the great voracity of the larvae during this period.

In the following period, *i. e.* when the larva refuses mulberry leaves and evacuates all its excrement a considerable decrease in the coefficient of osmotic pressure was observed. In the next period, *i. e.* when the larva rests preparatory to secreting the silk, the decrease in osmotic pressure is still greater owing to the greater concentration of organic liquids in the body of the larva. This increase of concentration of the liquid is, according to the writer, the primary cause of the resting period.

During the formation of the cocoon the larva loses a considerable quantity of water and the glands begin to degenerate causing a slight increase in the osmotic pressure.

The chrysalis has a higher osmotic pressure than the larva and this increase from one stage to another is the result of a loss of water which increases in proportion as the insect develops. The female chrysalides have a greater osmotic pressure than the males owing to the formation of eggs.

In the case of the adults the coefficient is greater than that of the chrysalides owing to the enormous development of genital glands, and during copulation the osmotic pressure rises still higher.

The writer has also studied the osmotic pressure in the eggs of silk worms and has found that it is in strict relation with their water content. The experiments are being continued with the object of clearing up other questions concerning the life of the silk worm.

FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

949 – **Agricultural Machinery and Implements in Russian Rural Economy** (1). — *Departément d'Agriculture, Industrie agricole en Russie*, pp. 21-28 (with diagrams and sketches) Petrograd, 1914. (In Russian and French).

The data given by the Central Committee of Statistics (Agricultural Implements and Machinery in Russia in Europe and Greater Russia, in 1910-1913), enable an estimate to be made regarding the distribution in the different districts in Russia in Europe of modern agricultural implements and machinery among the large landed proprietors and peasantry.

TABLE I. — *Distribution of modern implements of tillage in Russia.*

Percentage of modern implements calculated on all types	Number of districts in each group			
	Large estates		Peasant farms	
	Number	Percentage of total	Number	Percentage of total
Below 10 %	46	8.1	212	36.4
From 10–19 %	49	8.6	80	13.7
» 20–29 %	36	6.3	51	8.7
» 30–39 %	52	9.1	45	7.7
» 40–49 %	65	11.4	31	5.3
» 50–59 %	79	13.8	17	2.9
» 60–69 %	41	7.1	22	3.8
» 70–79 %	46	8.1	22	3.8
» 80–89 %	36	6.3	36	6.2
» 90 and over	121	21.2	67	11.5
Totals	571 (*)	100	583 (**)	100

(*) Excludes 19 districts where there are no large properties.
(**) Excludes 7 districts of Transcaucasus.

(1) See also *B.* Nov. 1910, p. 160; *B.* Aug.-Sept.-Oct. 1911, No. 2936; *B.* Jan. 1912, No 1[illegible] *B.* June 1914, No 562 ; *B.* July 1915, No 672. (*Ed.*).

Table I shows the districts of Russia-in-Europe grouped according to the percentage of modern implements of tillage they possess.

As a proof of the improvement in Russian agricultural machinery during the past decade we have the growth in the imports of machines and implements, the increase in the amount conveyed by rail into the interior, and the increased manufacture in the country itself.

Thus, in Table II, we have figures from the Department of Customs relating to the importation of agricultural machines and implements during the period 1895-1912.

TABLE II. — *Total imports of agricultural machines and implements.*

Years	Tons	Value
1895	24 304	£ 1 066 911
1896	21 371	1 024 524
1897	19 788	799 086
1898	29 281	1 213 104
1899	36 932	1 488 943
1900	41 699	1 676 074
1901	46 802	1 930 757
1902	59 678	2 135 281
1903	76 637	2 923 921
1904	68 216	2 177 256
1905	61 987	2 141 371
1906	66 651	2 141 138
1907	81 104	2 442 342
1908	72 779	2 931 163
1909	107 992	4 245 049
1910	115 057	4 453 157
1911	156 111	5 844 744
1912	171 988	6 288 556

During the period of five years 1898-1902 the total of machines and implements imported was 214 389 tons, including 42 078 tons of machinery for tillage; during the quinquennial period following, 1903-1907 these figures rose to 354 601 and 57 668 tons and in the period from 1908-1912 to 630 365 and 87 445 tons.

The transport of agricultural machines and implements rose during the period 1895-1912 from 80 609 tons to 478 820 tons.

The value of the total production in Russian ironworks and factories (not including the small type of home workshop) was in 1895 only £ 1 015 000 whilst in 1912 it amounted to £ 5 550 825. This latter sum is distributed among the different classes of machines in the following manner :

Class of Machine	Value	Percentage of total value (approx.)
Tillage Machines	£1 107 733	19.9
Drills and Sowing Machines	877 876	15.8
Harvesting Machines	1 393 098	25
Threshing do.	1 150 977	20.7
Winnowing do	260 942	4.7
Machines for the preparation of forage	140 620	2.2
Motors	280 290	5.0
Other agricultural machines and their duplicate parts	352 821	6.6
Total	£5 564 357	100.0

The zemstva play an important part in providing farm-holdings, especially small ones, with an improved agricultural outfit on the easiest terms. According to the figures given by the Statistical Bureau of the Council of the Mine and Metal Congress the annual turn-over of the zemstva depots in connection with the sale of agricultural machines, implements and articles in metal has risen from £ 528 650 to £ 1 469 647.

950 – **Wind-driven Device for Scaring Birds, Field-mice, Moles etc.** — *Deutsche Landwirtschaftliche Presse*, Year XLII, No. 35, p. 323. Berlin, May 1, 1915.

For the purpose of scaring mice, moles and the like from fields, gardens or meadows, Frau CHRISTINE KÄMPGEN has invented a simple and cheap

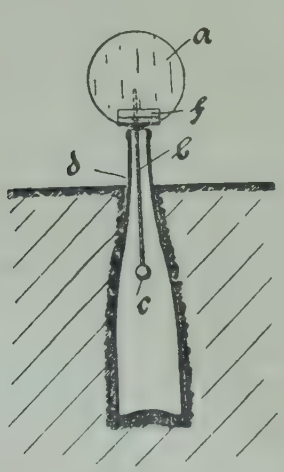


Fig. 1.

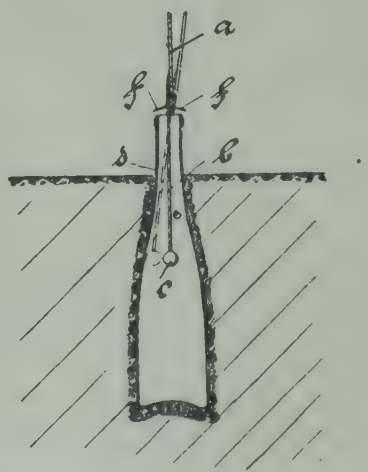


Fig. 2.

Aparato movido por el viento para espantar pájaros, ratones, etc.

device which has been patented in Germany under No. 275 264. It consists of a hollow vessel, such as a wine bottle for instance, sunk in the ground up to the neck and provided with a clapper driven by the wind, which, by beating against the inside of the bottle, produces a noise that in a short time scares the vermin away.

Fig. 1, is a front view and Fig. 2 is a side view of the device; *a*) is a bright metal disk to which the pendulum or clapper *c* is fastened by a small

rod. At the base of the disk two strips are attached so as to prevent the rain from getting into the bottle *d*, on the neck of which the disk is placed. When the latter is struck by the wind it moves to and fro and scares birds away and at the same time causes the clapper to beat against the inside of the bottle.

951 - **A New Multiple Honey Extractor.** — JACQUET, RENÉ in *L'Apiculteur*, 59th Year, No. 3, pp. 60-63. Paris, June-July 1915.

The apparatus consists of a drum supported by a stand on the frame of which rest the two ends of the axle passing through the centre of the drum. One extremity of the axle is fitted with a multiplying gear and handle. To the axle, within the receptacle, is attached a series of supports, each arranged for four frames. The supports are formed of several components, each consisting of an arm having at its distal end a fixed stop and at its basal (axial end) a moveable rest. By shifting this latter the support may be adapted to any size of frame ; it also allows, by means of a simple auxiliary arrangement, the substitution of two half frames for a complete one. Finally it compresses a spring for grasping and fixing the frame, acting like a pair of pincers the grip of which is strengthened by the rotatory movement.

The method of working is as follows :

The lid, which forms as it were the upper half of the drum, opens and discloses one of the supports, ready to receive the frame, the cell cappings having been removed beforehand. Each support is raised in turn and held in position by a brake. When all the supports have been filled with frames, which ensues in less time than with the old cage system, the cover is shut down and turning is begun. The honey is projected obliquely from the cells, streams down the walls and escapes at the bottom of the drum.

This new extractor curtails considerably the length of the operation, twenty frames being emptied in half the time required for four by the old method. There are no longer any damaged combs, pressure, or friction affecting the wax partitions. A further advantage is the safeguarding of the brood, for the honey leaving the cells obliquely, as it does, cannot sweep away the larvae. The apparatus, therefore, results in a considerable economy of time, money, bees and wax and also allows, with a little alteration, of the conversion of the apparatus still in use.

952 - **Appliance for the Treatment of Liquids in Thin Layers during Sterilisation by Ultra-Violet Rays.** — BILLON-DAGUERRE in *Comptes-Rendus de l'Académie des Sciences*, Vol. 161, No. 1, pp. 18-20. Paris, 5th July 1915.

In the sterilisation of water by ultraviolet rays (1) it is of considerable importance that the liquid should pass in thin layers as close to the rays as possible.

The author has put before the French Academy of Sciences an appliance for sterilising the water and drawing it off in actual contact with the lamp producing the rays, that is to say where the sterilising action reaches

(1) See *B.* Jan. 1912, No. 199. (*Ed.*)

its maximum. The water is drawn off by means of a T-shaped tube of pure transparent quartz. This tube is provided with a horizontal window in contact with which the lamp is placed (Figs 1 and 2). When the flow of water is considerable (5 000 to 10 000 litres per hr.), a second lamp is brought into use ; the tube is then provided with two exactly opposite windows or slits for the passage of the sterilised water (Fig. 3.)

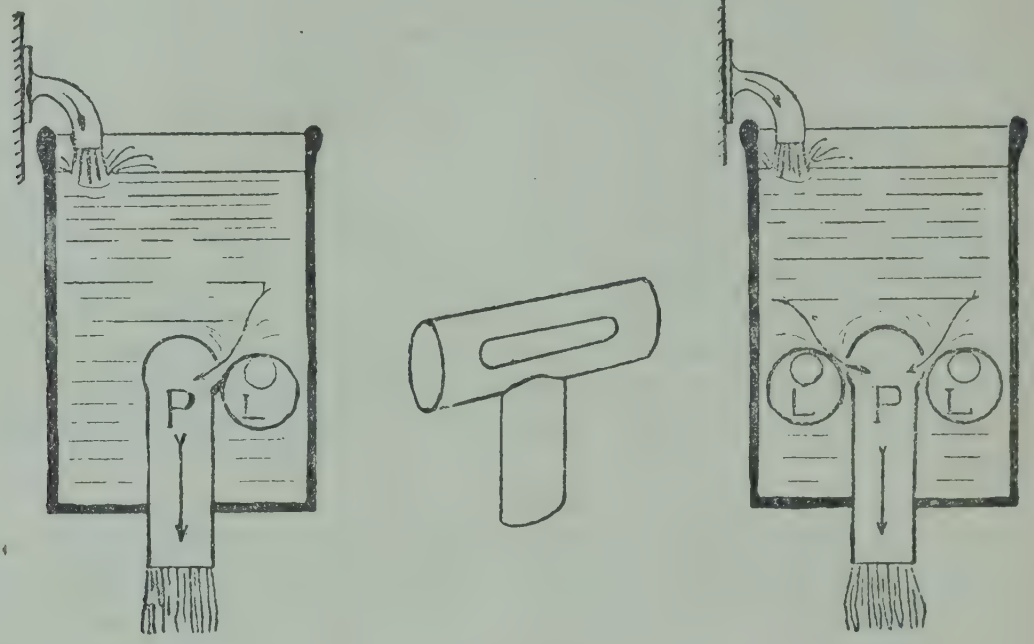


Fig. 3. Fig. 2. Fig. 3.

Appliance for the treatment of liquids in thin layers during sterilisation by ultra violet rays.

The inventor has tested his apparatus continuously over a period of 3 000 hours without reduction of current, on water from the Seine containing highly virulent cultures of *B. coli*, cholera vibrios, tubercle bacilli and other pathogenic germs. The total consumption of electricity for the two lamps in series was only 4 amperes 85 volts from a continuous current of 110 volts, and the rate of flow of the water was at least 10 000 litres per hr. As not a single pathogenic germ was found in the water outlet the result was more efficient and economical than any obtained hitherto.

953 – **Trials of Tractors at Allainville, France.** — SAGNIER, HENRI, in *Journal d'Agriculture Pratique*, Year 79, No. 50, pp. 456-457. Paris, July 1, 1915.

Count F. PILLET-WILL has recently imported from the United States of America some small tractors with the object of introducing them to French farmers, many of whom are at present encountering difficulties in getting their fields tilled owing to shortage of hands and teams.

About the middle of last June six of these tractors, hitherto unknown in France, were tried at Allainville (Seine-et-Oise, France) on one of the Count's farms, and in the presence of a number of farmers. Three of these tractors were "Bull" tractors, two were endless self-laid track tractors of the "Caterpillar" type and one a large four-wheeled type. They were all, save the latter, constructed for medium and small farms.

The Bull tractors have two large wheels, of which one is the driving wheel, and one small steering wheel, and a two cylinder horizontal motor. The smallest size is 11 feet long and 4 ft. 5 in. wide. It develops 10 HP. at the pulley of which 5 HP are available for haulage. It weighs 3520 lbs. and costs £120.

Their performance at Allainville was excellent, their simplicity, flexibility and easy management were a source of surprise to the spectators. These tractors can be hitched to a plough or other agricultural implement like a team and they work regularly and turn easily without requiring large headlands.

The caterpillars that were tried are 9 ft. 10 in. long, and 5 ft. 3 in. wide, they weigh 5280 lbs. and develop 10 HP. Their cost is £240.

954 – Review of Patents.

Tilling machines and implements.

British India	1 841. Implement for weeding and thinning plants.
Canada	161 084. Weeding implement.
	161 316. Potato hiller.
	161 664. Weed destroying machine.
Italy	147 218. Spade with extensible handle.
	147 568. New tooth for harrows.
Spain	60 324. Plough for extracting stumps.
	60 404. Turn-share plough.
Sweden	38 024. Rotary cultivator.
	38 060. Driving wheel for motor ploughs.
	38 117. Shovel blade.
	38 167. Motor plough.
	38 168 — 38 398. Stump pullers.
	38 324. Forest plough and seeder.
	38 290 — 38 396. Ditching machines.
	38 395. Rotary tilling machine.
United Kingdom	5 733. Garden and like rollers.
	6 450. Ploughing apparatus.
United States	1 140 409. Stump puller.
	1 140 564. Harrow.
	1 140 767 — 1 140 970 — 1 141 135 — 1 141 804. Cultivators.
	1 141 330. Extension harrow.
	1 141 467. Drag harrow.
	1 142 503. Weed cutting implement.
	1 142 081. Combined harrow and cultivator.
	1 141 997. Rotary weeder and cultivator.
	1 141 965. Plough.

Manure distributors.

Sweden	38 233. Manure distributor.
United States	1 140 371. Manure spreader.
	1 142 064. Guano distributor.
	1 142 197. Manure loading apparatus.

Drills and sowing machines.

Sweden	38 022. Ball bearings for sowing machines.
	38 118. Telescoping tubes for drills.
	38 346. Wheelbarrow sowing machines.
United States	1 140 755. Corn planter.
	1 142 400 — 1 142 481. Planters.
	1 142 515. Potato planter.
	1 142 314. Marker mechanism for planters.

Reapers, mowers and other harvesting machines.

Canada	161 075. Sheafloader.
	161 522. Flax harvesting machine.
Sweden.	38 023. Grain harvester.
	38 061. Horse rake.
	38 348. Drag rake.
United States	1 130 569. Peanut harvester.
	1 140 979. Harvester butt-board.
	1 141 298. Grain harvester.
	1 141 695. Hay rake.
	1 141 372. Kafir corn header.
	1 142 399. Bundle carrier.
	1 142 036. Driving mechanism for corn harvesters and the like.

Machines for lifting root crops.

United Kingdom	5 904. Machine for digging potatoes.
	6 381. Machine for lifting potatoes, bulbs, beets, etc.
United States	1 142 049. Uprooting mechanism for beet harvesters.
	1 142 048. Beet harvesters.

Threshing and winnawing machines.

British India	1 705. Threshing machine.
Canada	161 060. Threshing mechanism.
	161 201. Threshing machine.
	161 305. Grain cleaning machine.
Spain	60 313. New system of threshing machines which can be used for rice wheat and other kinds of grain.
	60 325. Winnowing machine.
	60 330. Improvement in winnowing machines.
Sweden	38 084. Beater for threshers.
	38 292. Straw shaker for threshers.

Machines and implements for the preparation and storage of grain, fodder etc.

British India	1 747. Improvement in toggle-lever baling presses.
	1 811. Improved machine and apparatus for drying par-boiled paddy and other grain.
	1 830. Device for cooling and cleaning rice and other cereals.
Sweden	37 879. Stand for drying hay.
	38 021. Apparatus for drying cereals in the sheaf, or hay.

United Kingdom 4 882. Baling press.
United States 1 141 088. Baling press.
1 142 181. Corn husker-shredder.
1 142 432. Hay sling.

Dairying machines and implements.

Sweden 37 915. Milk filter and cooler.
37 975. Device for milking machine.
38 166. Device for milk pails and the like.
38 236. Improvement in separators.
38 293. Milk-can for separators and applicable to rotating or oscillating churns.
38 294. Device for separators.
United Kingdom 6 006. Closures for milk churns.

Other agricultural imachines and implements.

British India 1 702. Improvements in instruments for tapping rubber-producing plants.
1 770. Apparatus for spreading tea leaf and the like.
1 843. Improvement in machines for treating flax and other fibrous plants.
1 851. Device for trapping insects.
Canada 161 334. Grain pickling device.
Cuba 2 271. Improvements in the mechanism for regulating the pressure of the cylinders in sugar mills.
2 274. Improvements in sprayers for the control of weeds.
Italy 147 307. Nozzle with faucet for sprayers.
147 550. Arrangement of the valves of sprayers in view of their accessibility.
147 306. Oesophagian, tube for the control of tympanitis in cattle.
133 501. Filter for sprayers.
157 736. Watering-can with valves.
147 744. Improvements in sprayers.
Spain 60 274. Automatic oil tanks and clarificators for oil for continuous filtration and clarification.
60 344. Improvements in transmission of power to oil mills.
60 358. Pruning apparatus for vines and trees.
Switzerland. 69 895. — 69 896. Device for gathering fruit from trees.
Sweden 38 083. Toothed wheel for agricultural machine.
38 295. Fly trap.
United Kingdom 5 570. Heckling machine.
5 742. Apparatus for drying tea, coffee, grain etc.
5 866. Tea rolling machine.
6 029. Chicken brooders.
6 087. Machine for cracking nuts.
6 215. Apparatus for coagulating rubber latex.
6 365. Apparatus for treating palm fruit.
United States 1 140 823. Autotractor.
1 140 969 — 1 141 126 — 1 142 066. Tractors.
1 141 295. Tractor operated by internal combustion engine.
1 142 148. Clevis attachment for draught evener.

RURAL ECONOMICS

RURAL ECONOMICS

955. – **Determination of the Capitalisation Value of Agricultural Estates and Lands.** — TANNER, KARL (Agrarökonomische Untersuchungen zum schweizerischen Zivilrecht unter besonderer Berücksichtigung des Ertragewertes landwirtschaftlicher Gewerbe und Grundstücke) in *Landwirtschaftliches Jahrbuch der Schweiz*, Year 28, Part 5, pp. 549-732. Berne, 1914.

In parts I and II of his work, the writer discusses the economic and social importance of the capitalisation value (value based on returns, " Ertragswert ") in agriculture, the question of agricultural taxation in general, and the position occupied by the capitalisation value of estates and farm-lands in the Swiss Civil Code and Cantonal laws, especially with regard to rights of succession and mortgage. Part III which is chiefly technical, deals with the actual determination of the capitalisation value of estates and farm-land. Chapter 1 contains a summary of the opinions and judgments of agricultural literature on the taxation of agricultural property based on the value of the returns ; Chapter 2 treats of the process for ascertaining the capitalisation value of agricultural estates based on the gross returns from their working, a method devised by Prof. LAUR (1) and adopted by the Swiss Peasants' Secretariat. After discussing the theoretical basis of this method the writer explains how it is technically applied in practice.

The first step to be taken in assessing an agricultural estate on the basis of its capitalisation value, is to determine the precise gross return from the estate. For this purpose a question form is employed which takes into account the details of the estate and thus enables the assessor to obtain an exact knowledge of the concern of which he has to determine the average gross returns for the last 5 to 10 years, Such returns will be also realizable in the future as they correspond to the general average of the region. The writer reproduces the question form employed for this purpose by the Swiss Peasants' Secretariat.

The second step consists in the choice of the coefficient for the determination of the capitalisation value from the table of these coefficients, taking into account the type of farming, the orientation of the production and the size of the concern to be valued.

This coefficient may be liable to small variations if the estate in question, owing to certain peculiarities, cannot be placed under any of the established heads in the table. On multiplying the gross income by the factor for the capitalisation value, the average capitalisation value of the estate is obtained (land-capital, building-capital, improvement-capital, cultivation-capital) the product of the combination of all the factors of production taking part in the agricultural concern and employed in accordance with local methods.

To determine the capitalisation value of the land itself, it is necessary

(1) See *B.*, September 1912, No 1337. (*N. d. R.*)

to deduct from the agricultural revenue, the returns from the buildings. For dwelling houses one takes into account the capitalisation value (the capitalised difference between rent and outlay, + the value of building material after demolition) ; for farm buildings, the value of construction is considered, and both are determined in relation to the economical value of the buildings. For the determination of the capitalisation value of each particular lot of ground, 3 different methods may be employed : the method based on the commercial value, the natural method, and the combined method. The method based on the commercial value, establishes the comparison between the capitalisation value and the commercial value of the estate as a whole, and with the help of this comparison and of the known commercial value of the lot in question, the capitalisation value of this lot is determined. — The natural process starts from the average capitalisation value per acre of the estate, from which the estimate of the lot in question is established according to its natural and economic conditions; this is done with greater exactitude by the aid of a system of points devised by Prof. LAUR, that is the number of points to be assigned is reckoned either according to the object of the assessment, or according to the average conditions of the agricultural property in question, or the average and customary conditions of the region. — The combined method (a combination of the 2 previous methods) first of all establishes the numerical ratio between the average capitalization value per acre of the estate, and its average commercial value per acre. Then it determines the average commercial value per acre of the lots belonging to the group of fields which include the lot to be valued. By aid of this latter value is then calculated, according to the method based on the commercial value, the average capitalisation value per acre of the land in this group of fields, which serves in its turn as the point of departure for valuing by the natural process. the particular lot in question. Applying the point system one then compares in the first place, the lot of ground to be valued with the average of all the lots belonging to the group of fields in question.

The capitalisation value of the bare land of an agricultural estate, can be obtained by deducting from the total capitalisation value of the estate the building-capital + the cultivation-capital ; it may however be directly calculated by the aid of the coefficients of the capitalisation value of the soil established *ad hoc* by the Swiss Peasants' Secretariat ; coefficients which represent the relation between the capitalisation value of the soil, and the gross revenue from the estate. To determine the capitalisation value of the bare land of each particular lot, the method based on the commercial value and the combined method can only be employed in restricted measure ; the natural method based on the point system may here be employed with advantage. If the capitalisation value of entire communes is to be estimated, one must first, as previously, determine the total gross revenue of the commune, then choose the average coefficient of capitalisation value, taking into account the average conditions obtaining in the commune as regards the type of farming, the trend of production, and the size of the estates ; multiplying the gross revenue by this average coefficient, the capi-

talisation value of the entire commune is obtained. — In order to calculate by the aid of this value, the capitalisation value of each particular lot, one may, as before, employ 3 methods. As general rule the method based on the commercial value may be employed ; the natural method is particularly advisable when the estates are isolated and have clearly defined boundaries, whilst the combined method is best employed when the buildings are clustered into villages, and where the demesne is much scattered. Likewise, the capitalisation value of the bare land of an entire commune can be calculated directly with the aid of an average coefficient of the soil's capitalisation value.

In the last Chapter the writer discusses briefly the relation between the unrestricted dealings in agricultural property, and the principle of capitalisation value; and advocates, in view of the more exact application of estimates based on capitalisation value, the extension of agricultural bookkeeping and the institution of valuation offices, similar to the one founded in 1914 by the Swiss Peasants' League (1).

The accompanying bibliography comprises 125 publications.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

956 - **On the Longevity of Artificiaf Cultures of Wine Yeasts Preserved in a 10 per cent Sugar Solution.** — MEISSNER, R. in *Zeitschrift für Weinbau und Weinbehandlung*, Year II, Part 3, pp. 103-107. Berlin, March 1915.

Of twenty-five cultures of different races of yeasts of Württemberg wine which had been stored since September 22, 1901 in 10 cc. of a 10 per cent solution of sugar in small Freudenreich flasks, 15 were found to be still alive at the beginning of 1912 whilst 9 were found dead at the end of 8 ¼ years. The remaining culture which still contained active cells was excluded from the experiment because sterile grape juice was added.

On April 21, 1913, of the 15 living cultures used to continue the experiment one was almost and two were already dried up, whilst the remaining 12 still contained some solution. On the same day 10 cc. of sterile distilled water was added to each of the 15 flasks and every precaution taken to avoid infection.

In December the dried or almost dry cultures were found to be dead whilst the remaining 12 cultures showed a strong development when inoculated into fresh sterile grape juice. The year following, *i. e.* in December 1914 these 12 cultures were again tested by inoculation with a platinum loop into sterile grape juice and incubated at from 20 to 22°C. By December 27, 1914, all the inoculations had produced fermentation, thus showing that these cultures had retained their vitality during 13 ¼ years.

On January 8, 1915, each culture was inoculated into 400 cc. of sterile grape juice and compared with similar inoculation of cultures

(1) See *B.*, February 1914, No. 171. (*Ed.*).

which had been transplanted into fresh juice at least 25 times in the course of the 13 years, the last occasion being December 28, 1914. The flasks closed with cotton wool and covered with filter paper, were weighed each day to determine the rate of fermentation in terms of the loss of weight of carbon dioxide.

The results showed that the 12 strains of yeast had lost none of their fermentation power during the 13 years of storage. In fact one of the 12 strains showed a greater activity than the cultures which had been kept fresh by transplantation.

The researches are being continued and further results will be published in due course.

957 - **Summary of Researches on the Presence of Coal Tar Dyes, in Wine.** — MASONI GIULIO in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Part. 5-6-7-, pp. 508-511. Modena, 1915.

The following reagents were used in these experiments: 1) 5 per cent solution of potassium ferrocyanide; 2) 15 per cent solution of neutral lead acetate. Two cc. of wine are placed in a test-tube and 2 cc. of ferrocyanide and 5 cc. of neutral acetate solution are added. The mixture is boiled for several seconds and set aside. A precipitate rapidly forms and after about 1 minute the liquid appears very limpid.

If the wine contains no coal tar colouring matter the liquid remains uncoloured, on the other hand the presence of dyes is indicated by a more or less intense rose colour. The reaction is not very distinct when the colouring matter is present in quantities less than 1 gram per hectolitre (22 gallons) but it is very pronounced for quantities of 2 to 3 gms. per hectolitre. The amount of dye required to produce an appreciable colour in the wine is at least 5 grs. per hectolitre so that this reaction is sufficiently sensitive for all practical purposes.

958 - **Influence of Citric Acid on the Keeping Qualities of Ciders Poor in Acid.** — MÜLLER-THURGAU, H. and OSTERWALDER, A. in *Landwirtschaftliches Jahrbuch der Schweiz*, Year 29, Part 1, pp. 48-53. Berne, 1915.

In these experiments the writers set out to determine if the addition of a certain quantity of citric acid will protect ciders of low acidity from degeneration and especially against the disease known as "Milchsäurestich" (1). The effect of citric acid was also compared with that of tartaric and lactic acids. A number of fermentation flasks of half litre capacity were filled with 400 cc. of the fresh juice of very ripe Theiler pears. No acid was added to some of the flasks and to others 2 or 4 gms. of tartaric acid, 2 or 4gms. of citric acid and 4 or 8 gms. of lactic acid per litre were added. The flasks were placed in a cupboard at a temperature of about 16° C.

(1) According to Müller-Thurgau (Die Bakterien in Wein und Obstwein und die dadurch verursachten Veränderungen, *Landwirtsch. Jahrb. der Schweiz*, Year 29, Part 1, pp. 55 and seq.) wines and ciders infected by the disease known as "Milchsäurestich" are characterised by a bitter-sweet taste and an odour suggestive of bad "sauer-kraut". The disease is caused by the presence of large quantities of lactic and acetic acid formed by the decomposition of sugar and malic acid by *Bacterium mannitopoeum* and *B. gracile*). (*Ed.*)

Samples of cider.	Before fermentation.		After fermentation			
	Total acid expressed as malic acid in gms. per litre	Non volatile acid expressed as malic acid in gms. per litre	Total acid expressed as malic acid in gms. per litre	Volatile acid expressed as malic acid in gms. per litre	Non volatile acid expressed as malic acid in gms. per litre	Lactic acid in gms. per litre
a) 60 *days after the beginning of the experiment* (*November* 20, 1912)						
Without acids	2,88	2.40	3.21	1.62	1.43	2.96
With 2 per cent citric acid .	4.62	4.37	4.82	1.09	3.62	2.30
» 4 » » » . .	6.49	6.24	6.80	1.08	5.61	2.08
» 2 » tartaric » . .	4.72	4.47	4.82	0.96	3.73	2.30
» 4 » » » . .	6.56	6.31	7.53	0.94	6.50	1.18
» 4 » lactic » . .	5.59	5.34	6.96	0.76	6.12	3.76
» 6,6 » » » . .	7.77	7.52	9.11	0.81	8.22	7.08
Unfermented sample	—	—	2.88	0.44	2.40	0.50
b) 8 *months after the beginning of the experiment* (*May* 1913)						
Without acids			6.23	3.81	2.04	5.40
With 2 per cent of citric acid			5.09	3.91	0.79	3.76
» 4 » » » »			5.02	3.45	1.23	4.32
» 2 » » tartaric »			4.58	2.23	2.13	3.46
» 4 » » » »			6.31	1.90	4.22	2.83
» 4 » » lactic »			5.99	1.05	4.84	4.56
» 6,6 » » » »			9.38	1.02	8.26	—

The presence of acids in the cider did not have much influence on the course of fermentation. However. towards the end of the fermentation there was a decrease in the flasks containing the tartaric acid and in those with the stronger dose of lactic acid. The addition of citric acid to the cider poor in acid had a rather favourable influence on the fermentation and the same result also occurred with the smaller dose of lactic acid.

The samples of cider were then submitted to chemical analysis 60 days after the beginning of the experiment and again later about half a year and the amount of acid was determined in each case. The results of these titrations are combined in the accompanying table and compared with the amount of acid before fermentation.

From these results and the results of a bacteriological examination of the samples of cider the writers draw the following conclusions:

Ciders of low acidity, like those used in these experiments are liable to spoil unless some preventive remedy is added. Certain acids may be

used as preservatives. Citric acid however is of no use as it is rapidly decomposed by certain species of bacteria (*B. mannitopoeum* and *B. gracile*) which are generally found in ciders of low acidity, with the consequent formation of a relatively large amount acetic acid. Even 4 per cent of citric acid does not prevent the growth and action of these bacteria.

Tartaric acid is better for this purpose, but according to these results a strong dose is required for a cider poor in acid. Two per cent was not sufficient to protect the cider against "Milchsäurestich" and even a dose of 4 per cent did not prevent the formation of acetic acid.

The addition of 4 per cent of lactic acid preserves the cider completely and has a much stronger influence than 4 per cent of tartaric acid, which is surprising considering that the acidity is greater in the latter case.

959 - **The Indian Sugar Industry: Notes on Machinery and Manufacture in Northern India, 1914.** — ABEL, PETER. (Harvey Engineering Company Limited, Glasgow) in *Agricultural Research Institute*, Pusa, Bulletin, No 47, pp. 1-16, Plates I-V. Calcutta, 1915.

The writer as representative of the Harvey Engineering Company of Glasgow was invited by the Government of India to ascertain the requirements of the Indian Sugar Industry with regard to sugar machinery and to advise the Government in connection with sugar matter generally where such advices was desired. His observations and suggestions may be summarised as follows:

Buildings. These generally appeared to be insufficiently lighted thus making cleanliness impossible. The approaches and exits are mostly badly arranged resulting in confusion of carts and animals and a considerable waste of labour. The accumulation of cane in the yard rendered impossible the grinding of cane in the order of its arrival causing difficulties in feeding the machines and a deterioration of the cane affecting the clarification of the juice and the quality and extraction of sugar.

Feeding the machinery. This is done by hand and involves a great deal of labour and supervision. Owing to the absence of railways in the factories the various mechanical arrangements in vogue in other parts of the world cannot be adopted in India. Much of the congestion, however, might be relieved by the use of the transfer crane of the American Hoist and Derrick Co. as used in Mexico.

Manufacture. The percentage of juice obtained in Bihar factories is quite satisfactory though in most factories there were complaints as to its quality.

As a rule the appliances for clarification were unsatisfactory in construction and their use very inefficient.

The evaporators appeared to be sufficient for their work but their cleaning requires more attention. Any shortcomings in the quality of the sugar were attributable to the faulty construction and working of the clarifiers.

With a few modifications and additions to the factories the writer believes that the Indian sugar industry need not be far behind that of Java in the matter of sugar extraction.

84 – **Cane Wax as a By-Product of the Cane Sugar Industry.** — CROSS, W. E. (Chemist, Tucuman Agricultural Experiment Station) in *The International Sugar Journal*, Vol. XVII, No. 199, pp. 311-313. London, July 1915.

The white powdery substance which occurs on the outer surface of the stalk of the cane especially in the region of the node consists of a very hard yellowish wax of specific gravity 0.961 and melting point 82° C. DUMAS describes it as an alcohol of the formula C_{24} H_{50} O and LEWEY as C_{24} H_{48} O. On account of its hardness and high melting point it has possibilities as a substitute for carnauba wax, which command a price of about 1 shilling per lb. Various attempts have been made to devise a suitable method for its abstraction, but at present no really satisfactory method has been found.

The crude wax obtained from filter-press cake by extracting with organic solvents is very impure, containing fats and oils as well as the cane wax itself and therefore is much softer and of lower melting point than pure cane wax. The extraction and disposal of this crude wax would probably be unprofitable. Pure cane wax can be obtained from the crude wax extracted from press cake by fractional crystallisation from benzine, but only a relatively small yield is obtained. The pure wax is best obtained from the raw juice by centrifugal action, the crude product being purified by crystallisation from denatured alcohol. With the perfection and adoption of juice centrifugals it is hoped that the extraction of cane wax may become a commercial success.

961 – **The Food Value of Wheat Flour and Bread in Relation to its Phosphorus Compounds.** — MASONI GIULIO, in *Le Stazioni Sperimentali Agrarie italiane*, Vol. XLVIII, Part 5-6-7 pp. 385-456. Modena, 1915.

Part. I. — The writer gives an account of the literature on this subject and the results of his analyses (see Tables I and II) from which the following conclusions are drawn :

1) the total quantity of phosphorus, relatively small in the finest flours, always increases in the more inferior flours and still more in the secondary products, reaching its maximum in the bran.

2) the total organic phosphorus compounds are in excess of the total mineral phosphates ;

3) of the different organic combinations of phosphorus the phytin compounds preponderate ; the proportion of nucleins is less and that of lecithin still less. The proportion of phytin compounds and to a less extent that of the nuclein compounds increases almost proportionally with increase in the total phosphorus. Although the phosphorus of nucleins appears in stronger proportions in the products containing most phosphorus (pollards and bran) the differences between them and the other products in regard to these phosphorus compounds are much less appreciable ;

4) the proportion of mineral substances and ethereal extract always increases in passing from finer flours to bran.

Comparing the percentage of phosphorus in the different phosphorus compounds of flour and of bread it is found that whilst the phosphorus of the phytin and nuclein is almost in the same proportion in bread as in flour, considering the greater humidity of bread, the lecithinic phosphorus

is in a considerably less proportion in bread. (Lecithins easily decompose under the action of heat and it may be also that the yeast may cause changes in the phosphorus compounds of flour).

TAELB I. — *Analyses of flour and milling residues.*

Type of mill.	Quality and name of product.	Yield. per cent.	Percentages of substance in natural condition.						
			Moisture	Ash.	Ethereal Extract.	Total P_2O_5	P_2O_5 as Lecithin	P_2O_5 as Phytin.	P_2O_5 as Nuclein
Stone rollers	Flour of 1st qual.	19.10	13.90	0.420	0.500	0.240	0.020	0.102	0.090
	» » 2nd »	25.84	14.10	0.560	0.740	0.358	0.018	0.180	0.110
	» » 3rd »	16.85	14.25	0.780	0.900	0.480	0.028	0.280	0.120
	Sharps.	17.79	13.85	1.000	1.485	0.589	0.029	0.310	0.180
	Pollard	8.42	14.60	2.480	2.090	1.428	0.040	0.810	0.150
	Bran	17.50	14.55	5.680	3.350	3.122	0.041	1.997	0.200
	Milled wheat. . .	—	14.20	1.690	1.460	0.975	0.030	0 588	0.145
Cylinders	Flour bran B . .	70	15.66	0.480	0.680	0.264	0.026	0.110	0.100
	Sharps.	5	14.20	1.320	1.400	0.480	0.026	0.231	0.150
	White pollard . .	3	14.08	3.640	3.360	1.971	0.033	0.974	0.204
	Dark pollard . . .	4	14.94	4.300	3.680	2.304	0.040	1.254	0.206
	Bran	18	14.50	5.900	3.502	2.994	0.038	2.457	0.283
	Milled wheat. . .	—	15.05	1.760	1.660	0.860	0.032	0.609	0.130

The first analysis refers to "Rieti" wheat, the second to an undetermined variety.

The percentage of yield refers to grain moistened with 1 per cent of water.

The flour is distinguished as 1st, 2nd and 3rd quality or brand A, B, C. Brand A is used by high class bakers and confectioners; brand B is a common flour for white bread; brand C known as "corpo" is used for brown bread; ("Codetta") sharps and pollard ("Farinetta") are intermediary products between flour and the secondary products.

Part II. — The writer has determined the proportion of phosphorus and nitrogen soluble in water, in 2 per thousand hydrochloric acid and in hydrochloric acid pepsin in wheat, wheat products and in bread. Some of these results are given in Tables III and IV. The principal results of Table III with regard to phosphoric acid are: 1) "Calbigia" wheat during milling undergoes a greater pulverisation of the cortical parts and gives a flour richer in total phosphorus compounds than "Fucense" wheat, although the grains of the latter may be richer in phosphorus compounds, thus showing that the variety has a great influence on the quality of the milling products;

2) in all cases high yielding flours are aways richer in phosphorus compounds.

3) bran is always richer in phosphorus in proportion as the cortical detritus is more abundant ;

4) the solubility in water of the phosphorus compounds of flour can be represented with a certain approximation, by $^{6}/_{10}$ of the total phosphorus ; whilst in the case of bran it varies between $^{3}/_{10}$ and $^{4}/_{10}$;

5) the solubility in hydrochloric acid at 2 per thousand does not differ much for flours from the solubility in water, whilst it is higher in the case of bran ; in the purest bran it may reach to $^{8}/_{10}$ and more ; presumably this may be attributed to the high proportion of phosphorus in the form of phytin occurring in bran.

6) the solubility in hydrochloric acid pepsin is in all cases much superior to that in water and hydrochloric acid at 2 per thousand ; in flour and bran it generally varies from $^{8}/_{10}$ to $^{9}/_{10}$ of the total.

TABLE II. — *Analyses of bread.*

Brand of flour and type of mill.	Quality of bread.	Percentages of substance in natural state						
		Moisture.	Ash.	Ether Extract.	Total P_2O_5	P_2O_5 as Lecithin	P_2O_5 as Phytin.	P_2O_5 as Nuclein
	Trade ;							
B, with cylinders . .	white	33.10	0.470	0.542	0.228	0.007	0.130	0.080
Corpo, with millstones	brown	36.70	0.630	0.876	0.356	0.007	0.160	0.130
B, with cylinders . .	white	32.20	0.322	0.480	0.180	0.005	0.090	0.070
Corpo, with millstones	brown	34.50	0.590	0.712	0.280	0.006	0.160	0.110
	Home made :							
dark flour.	brown	30.30	0.952	1.230	0.412	0.005	0.195	0.120
» »	„	35.20	0.860	0.800	0.389	0.007	0.150	0.150

With regard to the nitrogen :

1) there is no notable difference with regard to the total nitrogen between the flours of different yields and between the brans of the same lot ; whilst there are slightly more appreciable differences between flours and brans with regard to the greater richness of the latter ;

2) the solubility in water of nitrogen compounds is about $^{3}/_{10}$ of the total in the case of flour, whilst it may reach an average of $^{4}/_{10}$ in the case of bran ;

3) the solubility in 2 per thousand hydrochloric acid is greater than in water in the case of flour since it may reach $^{4}/_{10}$; whilst in the case of bran it is almost the same as in water ;

4) the solubility in hydrochloric acid pepsin is much more considerable in the case of flours, reaching $^{9}/_{10}$; it is less with bran, reaching about $^{8}/_{10}$.

It must not be forgotten, however, that the digestibility of bran i

TABLE III. — *Percentage composition and solubility of wheat and wheat products.*

	Type of dressing machine	Moisture	Ash	P_2O_5				Nitrogen			
				Total	water soluble	soluble in 2‰ HCl.	soluble in acid pepsin	Total	water soluble	soluble in 2‰ HCl.	soluble in hydrochl. pepsin
"Calbigia" wheat											
Milled wheat	—	14.10	1.760	1.102	0.621	0.610	0.807	2.180	0.620	0.697	1.810
Flour of 70 % yield . .	hair	13.90	1.240	0.741	—	—	—	—	—	—	—
„ „ 70 „ „ . .	silk	14.10	0.920	0.600	0.342	0.348	0.490	2.050	0.539	0.837	1.850
„ „ 80 „ „ . .	hair	14.05	1.220	0.760	0.392	0.390	0.600	2.100	0.520	0.800	1.870
„ „ 90 „ „ . .	»	13.80	1.280	0.860	0.480	0.517	0.668	2.150	0.465	0.703	1.870
Bran „ 30 „ „ . .	silk	14.05	3.730	2.270	1.000	1.570	2.120	2.200	0.700	0.700	1.600
„ „ 20 „ „ . .	hair	14.00	4.120	2.450	1.168	1.650	2.120	2.240	0.744	0.677	1.640
„ „ 10 „ „ . .	»	14.10	6.060	3.369	1.423	2.600	2.113	2.310	0.745	0.697	1.710
"Fucense" wheat											
Milled grain	—	14.20	1.660	1.073	0.700	0.710	0.838	2.270	0.640	0.680	1.855
Flour of 70 % yield . .	hair	14.25	0.800	0.580	—	—	—	—	—	—	—
„ „ 70 „ „ . .	silk	14.10	0.720	0.520	0.342	0.295	0.470	2.170	0.418	0.785	1.900
„ „ 80 „ „ . .	hair	14.00	0.860	0.650	0.400	0.386	0.550	2.200	0.510	0.750	1.835
„ „ 90 „ „ . .	»	15.05	1.100	0.770	0.440	0.428	0.655	2.200	0.480	0.690	1.880
Bran „ 30 „ „ . .	silk	13.85	3.670	2.330	1.100	1.635	2.010	2.545	0.690	0.710	1.900
„ „ 20 „ „ . .	hair	14.05	4.900	2.750	1.150	1.630	2.310	2.600	0.730	0.735	1.900
„ „ 10 „ „ . .	»	14.30	6.680	3.809	1.348	2.760	3.382	2.870	0.772	0.793	2.120

TABLE IV. — *Percentage composition and solubility of bread.*

Leaven used in making the bread from "Calbigia" wheat . . .	43.45	0.480	0.248	—	—	—	1.590	—	—	—
Whole meal bread *	34.30	1.150	0.705	0.508	0.508	0.500	1.650	0.279	0.234	1.290
Bread from 70 % (silk) *	33.20	0.655	0.411	0.320	2.290	0.270	1.620	0.310	0.290	1.350
„ „ 80 „ (hair)	36.40	0.831	0.504	0.340	0.378	0.390	1.620	0.260	0.300	1.520
„ „ 90 „ („)	35.90	0.868	0.562	0.400	4.425	0.400	1.630	0.186	0 228	1.480
With "Fucense" wheat										
Whole meal bread.	36.10	1.080	0.723	0.485	0.500	0.490	1.690	0.213	0.232	1.300
Bread from 70 flour (silk)	34.50	0.537	0.361	0.246	0.252	0.280	1.650	0.232	0.233	1.410
„ „ 80 „ (hair) . . .	34.10	0.621	0.440	0.300	0.322	0.300	1.650	0.335	0.300	1.510
„ „ 90 „ („) . . .	36.15	0.764	0.512	0.310	0.330	0.350	1.630	0.199	0.242	1.430

* Product of the entire grain.

chiefly proportional to its fineness. LOPRIORE (*Stazioni Sperimentali agrarie italiane*, 1915, p. 297) showed by means of artificial digestion experiments that with wheat bran the digestibility of nitrogenous matter was 85.9 per cent for fine bran and 79 per cent for coarse bran.

The results of table IV with regard to the phosphoric acid shows :

1) that the total quantity of phosphorus compounds is greater in bread manufactured from the heaviest yielding flour and very high in bread made from whole flour;

2) that the solubility in water or 2 per thousand hydrochloric acid shows little difference and remains in almost identical or a little higher proportions that of the flour.

3) that the solubility in hydrochloric acid pepsin is not very different from that in 2 per thousand hydrochloric acid.

With regard to the nitrogen :

1) the proportion of total nitrogen is not appreaciably different in various kinds of bread;

2) the proportion of nitrogenous substances soluble in water and 2 per thousand hydrochloric acid is little diminished in comparison with the corresponding flours, since it is generally below $^{3}/_{10}$ of the total, which is easily accounted for by the changes in the nitrogenous matter caused by heat during the baking of the bread ;

3) the proportion of nitrogenous substances soluble in hydrochloric acid pepsin remains almost the same as in flour, and varies between $^{8}/_{10}$ and $^{9}/_{10}$.

With regard to the notable solubility in water of the phsphorus compounds of farinaceous substances the writer points out the desirability of avoiding the loss of considerable quantities of phosphorus compounds in the cooking waters of various vegetable foods. Researches on this point have already been initiated.

An appendix contains a bibliography mentioning 74 works.

962 – **Composition of the Grain, Flour and Milling Offals of Four Varieties of Irish Wheat.** — HUNTER H. in *Department of Agriculture and Technical Instruction for Ireland Journal*, Vol. XV, No. 3, pp. 550-562. Dublin, April 1915.

In 1908 the Department of Agriculture and Technical Instruction for Ireland commenced a series of experiments with the object of determining the agricultural and milling values of Red Fife, Square Head Master, White Queen and White Stand-Up Wheats. The Irish Miller's Association cooperated in these experiments. These researches gave the opportunity of investigating the composition of the various milling by-products. The varieties of wheat studied were cultivated in one experimental centre in 1908 and in 3 centres in 1909, in deep loam; the varieties of seed used for the 3 experimental centres in 1909 was obtained from one bulk. From the analytical results given by the writer in detail for each variety and locality during 2 years, the following general averages, relating to all 4 varieties are deduced, and given in Table I. The percentages are calculated on dry matter.

TABLE I. — *General Composition of Wheat and Milling Offals.*

	Oil	Albuminoids	Carbo-hydrates	Fibre	Ash
	%	%	%	%	%
Wheat Grain	2.00	13.75	80	2.5	1.75
Flour	0.75	12.75	86	0.0	0.50
Bran	4.00	15.00	61	12.0	7.00
Pollard	4.50	16.00	68	5.5	4.00
Germ Meal	7.00	22.00	62	2.7	4.20

According to Table I the composition of *Flour*, as compared to the wheat from which it was derived shows the following changes: decreases in the percentages of oil, albuminoids and ash, elimination of fibre, and an increase in the percentage of carbohydrates.

Bran is characterised by relatively higher percentages of oil, albuminoids, fibre and ash, and by a much lower percentage of carbohydrates than is present in either the original grain or in the flour.

Pollard differs from bran in the higher percentages of carbohydrates and albuminoids; and lower percentages of fibre and ash.

Germ Meal is characterised by high percentages of oil and albuminoids; in carbohydrates it approximates to bran; in fibre to the original grain; and in ash to pollard.

The percentages of moisture in the different products, show a considerable variation, as shown in Table II. — The figures relating to 1909 are the averages of the data of 3 localities:

TABLE II. — *Percentage of moisture in Wheat, Flour and Milling Offals of 4 varieties of Irish Wheat.*

Varieties	Wheat Grain	Flour	Bran	Pollard	Germ Meal
Red Fife 1908.	15.22	15,81	12.75	14.55	12.77
» » 1909.	14.28	12,60	11.05	10.64	9.69
White Queen 1908.	15.45	15,40	13.92	13.95	13.10
» » 1909.	14.79	12,62	11.17	10.39	10.54
White Stand-Up 1908	15.33	15,24	13.34	14.52	13.22
» » » 1909	13.63	12,67	10.39	11.47	10.75
Square Head Master 1908 . . .	15.43	15,70	14.83	14.63	13.32
» » » 1909 . . .	13.70	12,85	11.95	11.58	9.94

The result of analyses shows that the composition of the grain of each variety obtained in 1909 in three different centres, is stikingly similar, especially in regard to the percentages of carbohydrates and albuminoids. Therefore, *each variety of wheat possesses a composition peculiar to itself, upon which the nature of the soil and the climate of the locality in which it is grown appear to exert no influence.* The differences in the composition of the grain of the four wheats under discussion are the direct cause of the differences noted in the composition of the flour and offals obtained from the varieties after milling.

There is no difference in the composition of the bran and pollards of the two red wheats, Red Fife, and Square Head Master, and the two white wheats, White Queen, and White Stand-Up; therefore these results do not support the opinion that white bran is a better feeding material than red bran.

When the germ meal is not separated from the bran and pollard during milling, the proportion in which it occurs in these two products has a great influence on their composition because of its richness in oil and albuminoids.

963 - **The Manufacture of Bread from Potatoes in Germany** (1). — *Zeitschrift für das gesamte Getreidewesen*, Year 7, No. 5, pp. 115-124. Berlin, May 1915.

A report issued by the Imperial Department of Hygiene to inform the German public on the possibility of using potatoes in the manufacture of bread. It is based on numerous baking experiments and gives an exact idea of the present state of knowledge on this subject in Germany. The conclusions of this report are as follows :

1) The method of improving the quality of cereal flours by means of potatoes or replacing part of the flour by potatoes has been in vogue several years in Germany.

2) In place of the tuber use is often made of its dry products such as potato flour and potato flakes.

3) A limited quantity of potatoes added to flour does not injure in any way the quality of the bread.

4) As much as 20 per cent of potatoes may be added to rye flour if the method of bread making is carefully chosen and applied; such bread is not different in appearance from that made exclusively from rye flour.

5) By replacing a part of the cereal flour by potatoes a greater weight of bread is obtained than by using exclusively cereal flour.

6) The nutritive value of potato bread expressed in calories is somewhat lower than that of cereal bread.

7) Potato bread contains a little less protein than cereal bread but this difference is very small when not more than 5 per cent of potatoes are used. It is only noticeable when 20 per cent of potato is baked with rye flour containing much bran.

8) Finally, bread containing 80 per cent of rye flour and 20 per cent

(1) See also *B.* May 1915, N° 544. (*Ed.*)

of potatoes differs very little from a bread made exclusively of rye flour. Bread containing more than 5 per cent of potatoes should be declared as such when sold.

964 - **Manufacture of Bread from Flour with Sugar Beets in Germany.** — NEUMANN and FORNET (Communication from the Experiment Station for the rational use of cereals at Berlin) in *Zeitschrift für das gesamte Getreidewesen*, Year 7, No. 4, pp. 98-97. Berlin, April 1915.

Series I. — The writers have made bread from flour with both fresh and cooked sugar beets by replacing 10 per cent of the flour by an equivalent quantity of dry matter of beets. Since fresh beets contain 80 per cent of water 50 parts of beets were mixed with 90 parts of rye flour. The beets were peeled, then pounded and mixed with rye flour. Leaven was then added to favour fermentation. The usual process of bread making was followed but the taste of the bread was unsatisfactory owing to the characteristic flavour of beets.

In a second experiment brewers' yeast was used and the result was less satisfactory than before.

In a third experiment cooked beets were used. After cooking they were pulped, mixed with rye flour and fermented with leaven. Fermentation was slow and the bread did not rise. The crust was however normal and the taste slightly sweet without the flavour of beets.

Series II. — Attempts were made to make bread with flour from whole beets and from beet slices. In one experiment 10 per cent and in another 5 per cent of rye flour was replaced by the beet flour. Fermentation was normal in both cases. The bread made fom flour from whole beets had a dark brown crust and yellow-brown crumb, the pores were regular and the taste slightly sweet but agreeable and not resembling that of beets. The bread made from flour from beet slices had a less agreeable taste and the dough was a greyish green colour.

Cakes made with a mixture of 30 per cent of beet flour and 70 per cent of rye flour were found very good.

Series III. — In these experiments beet sugar was used, raw sugar being used with rye flour and refined sugar with wheat flour. The first dough contained 75 to 85 per cent of rye flour and the second 80 per cent of wheat flour. The bread containing rye flour and raw sugar rose well in the oven, had a normal appearance and perfect quality. The sweetness of the sugar was no longer prominent. A similar result was obtained by replacing a part of the rye flour by potato flour.

In the experiments made with wheat flour and refined sugar it was found more advantageous to use a smaller amount of sugar. The quality of the bread containing more or less sugar was considered very different by the judges, but in every case containing not more than 5 per cent of sugar the bread was considered good.

Series IV. — These experiments were made to test the value of molasses or beet syrup in the manufacture of rye bread. The first dough contained 82 per cent of rye flour and 5 per cent of sugar and gave good bread. In a

second experiment with 6 per cent of molasses a bread of average quality was obtained.

Summarising the results of these experiments the writers conclude:

1) The use of fresh beets in bread making is not advisable. Only cooked beets are suitable for this purpose.

2) Flour from whole beets or slices may be used but in quantities of not more than 5 to 10 per cent of the cereal flour.

3) Sugar may be used in all cases but the dough should not contain more than 5 per cent.

4) Syrup and molasses should not be used in bread-making unless necessary. The former is more suitable than the latter and may be used at the rate of3 to 5 per cent.

965 - **Butyric Fermentation in Bread-Making in the Province of Rome.** — PEROTTI R. and CRISTOFOLETTI U. in *Le Stazioni Sperimentali agrarie italiane*, Vol. XLVIII, Part 5-6-7, pp. 341-384. Modena 1915.

At Velletri (province of Rome) there is made a bread of excellent quality, which has organoleptic properties different from those of bread made in the neighbourhood. The fact that bread made at Rome with leaven from Velletri does not possess the characters of the true Velletri bread suggests that there are other factors apart from the fermentation process such as climate and water, contributing to the quality of the bread. Examination of the microorganisms present in the leaven and of the fermentation produced by them in the dough shows the frequent occurrence of a butyric ferment suggesting *Bacillus butyricus* Pasteur which cannot be distinguished from *Clostridium butyricum* Prazmowski and *Bacillus amylobacter* Trécul and Vàn Tieghem. The following have also been isolated: a small saccharomycete resembling *Saccharomyces minor* Engel, another of average size not yet determined and a small aerobic bacterial form which was subsequently eliminated as being of negligible importance.

The study of the morphology and physiology of these micro-organisms from the point of view of their fermentative properties led to the following conclusions :

The abundance of *Cl. butyricum* in Velletri leaven as well as the organoleptic characters of the local bread made with leaven and with artificial yeasts containing this bacterium, gives evidence to show that the good qualities of Velletri bread are due to the influence of butyric fermentation. There is however no doubt that an exclusive or even excessive action of this micro-organisms is injurious to bread making. Bread made with a leaven consisting of *Cl. butyricum* is full of numerous small cavities, with a furrowed and cracked crust, too moist and of a disagreable taste. By introducing into the leaven saccharomycetes (especially *S. minor* and *Cl. butyricum* at the same time very satisfactory results are obtained, provided a correct proportion be kept between the saccharomyces and the bacteria.

Apart from the rising of the dough attention must be paid to the taste and odour imparted by the leaven. It will therefore be useful to continue investigations with a view to determining the importance of bacteria in bread making besides that of the saccharomycetes.

966 - **Storing Bread with its Natural Moisture.** — FLEURENT, E. (Relating to bread supplied to prisoners of war) in *Comptes-Rendus de l'Académie des Sciences*, Vol. 161, No. 3, pp. 55-56. Paris, July 19, 1915.

Whilst still warm the bread is wrapped in two separate sheets of strong paper or parchment paper and tied up.

The packeted bread is then replaced in the oven when the temperature has fallen to 120°-130° C. for about 15 to 20 minutes. On cooling the bread may be dispatched with the usual precautions. Packed in this way the bread will remain good for a month or more even though stored in a dark moist cellar and re-appear in a condition equal to ordinary stale bread.

967 - **Experiments on the Catalytic Hydrogenation of Oil from the French Colonies, 1st Series of Experiments, "Karité" of French West Africa and "Aouara" of Guiana.** — HEIM, H, and HEBERT, A. in *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 8, No. 59, pp. 238-244. Melun, May 1915.

Industrial and commercial interest in catalytic hydrogenation. — Fats consist of mixtures of glycerides of fatty acids either saturated or unsaturated. In the first case they, as well as the fat in which they are found, are solid, in the second they are liquid. Excluding drying oils, fats contain scarcely any non saturated acid other than oleic acid $C_{18}\ H_{34}\ O_2$. On hydrogenation this acid which is liquid at ordinary temperatures is transformed into stearic acid $C_{18}\ H_{36}\ O_2$ which is a saturated acid melting at 70° C. Generally the higher the melting point the higher the price of the fat. Consequently the hydrogenation of fats in raising the melting point becomes of considerable commercial and industrial importance provided that the operation is conducted on an economic basis.

Thus a totally new industry has begun. The products obtained up to the present have been used almost exclusively in soap making. They have not yet been used in candle making, but their use as food has already been discussed.

Experiments on the hydrogenation of Karité (Butyrospermum parkii) butter and fat of Aouara nuts (Astrocaryum vulgare). — The above fats mixed with the caltalyser were placed in flasks and pure dry hydrogen was passed through at a pressure of 1 to 2 cm. of mercury above atmospheric pressure. The process was carried out at a temperature of 50° C. and also at 180°-200° C. and lasted during 12 hours with constant agitation of the mixture. As catalysers reduced platinum in the proportion of 1 per cent and reduced nickel in the proportion of 5 per cent were used. At the end of the process the mixture was dissolved in benzine and the fat obtained by evaporation of the solvent.

The effects of the hydrogenation process are shown in the following table. The iodine value diminishes with the quantity of non-saturated acids and therefore forms a double criterion of the amount of fixation of hydrogen that has taken place.

Treatment	Karité butter		Fat of Aouara nuts	
	Melting Pt.	Iodine value	Melting Pt.	Iodine value
Initial	32° C.	65.6	30° C.	9.5
After hydrogenation with platinum at 50° . .	35° »	57.6	30°–31° »	9.2
» » » 180°-200°	67°–68° »	16.0	32° »	8 1
» » » nickel 50° . . .	34°–35° »	48 0	30°–31° »	9.0
» » » » 180°-200°	69°–70° »	9.6	32° »	6.7

Thus, hydrogenation at 180°—200 has produced a considerable rise in the melting point and a considerable decrease in the iodine value of Karité butter showing a rapid hydrogen fixation with the oleic acid forming stearic acid. With the Aouara fat, on the contrary, the amount of hydrogen fixation is too small to balance the expense of the process.

968 – **Note on Lemon Oil.** — BENNET, ALEX. H. in *Bollettino della Camera Agrumaria*, Year 1, Part 5, pp. 23-24. Messina, April 1915.

The factors concerned in the valuation of the essence of lemons are the citral content, the specific gravity and the optical rotation. While the citral content is a real indication of the quality of the essence, the writer considers that the rotation is not so valuable a diagnostic factor.

A minimum of 58° would exclude from the market all the richest essences of the Messina district whilst a minimum of 61° (Australian law) is only reached by a small portion of the production which, according to other standards, is not of the best quality. On the other hand the rotation standard was justifiable when the essence was most commonly adulterated by turpentine which lowered the index of rotation.

This fraud is now easily detected by other tests and other means of adulteration are practised such as the addition of terpenes obtained from the preparation known as "essence without terpenes" or the addition of refined fixed oils (white vaseline, etc.) which are easily recognisable.

Also a high citral content is generally accompanied by a low rotation index and this year's crop is characterised by an exceptionally high percentage of citral.

The writer therefore recommends the establishment of a minimum for the citral content, and in place of a standard for the rotation, adopting the surer analytical tests for the degree of purity.

Experiments have also been started on the keeping qualities of the essence under different conditions. The results obtained after three months with *a*) unfiltered essence stored in copper vessels; *b*) filtered essence stored in copper vessels; *c*) filtered essence stored in glass vessels, in each case not free from moisture; and *d*) with dried essence in contact with sodium sulphate, have shown that there is no remarkable change and only a small

decrease in the citral content. The experiments are being continued to study the changes which may occur during the warm months of the year.

969 - **Analysis of Tomato Pulp.** — BIGELOW, W. D. and FITZGERARD, F. F. (National Canner's Association, Washington, D. C.) in *The Journal of Industrial and Engineering Chemistry*, Vol. 7, No. 7, pp. 602-606. Easton, Pa., July 1915.

The data upon which the following generalisations are made, were obtained from several analyses of a remarkable number of samples of fresh and preserved tomatoes as well as pulps prepared under known conditions. The filtered liquor was obtained by filtering through a folded paper either a sample of tomato pulp or from crushed tomatoes, after cooking the fresh fruit in a reflex condenser. The determination of the solid matter was made by desiccation in vacuo at 70° C. and at 100° C. at atmospheric pressure. The following empirical relations were obtained:

1) The solid matter in pulp dried in vacuo=solid matter in pulp dried at atmospheric pressure × 1.085.

2) The solid matter in pulp dried in vacuo=solid matter of filtered liquor dried in vacuo × 1.125.

3) The solid matter of the filtered liquor dried in vacuo=solid matter of filtered liquor dried at atmospheric pressure × 1.12.

From the specific gravity of the filtered liquor at 20° C. the percentage of solid substances in the pulp can be determined by means of Windisch's tables for wine and deducting 0.5 per cent from the percentages given.

The solid matter of the filtrate may also be determined from the refractive index by using Wagner's tables for extract of beer and wine, which may be used equally well for the juice of fresh and preserved tomatoes without correction. In applying them to the filtered liquor of a pulp of ordinary concentration 0.17 must be deducted from the percentage obtained.

Further, if the product is salted the amount of sodium chloride must be determined and correction made accordingly.

970 - **Comparative Experiments on the Pasteurisation and Biorisation of Milk.** — BURRI, R. and THAYSEN, A. C. in *Schweizerische Milchzeitung*, Year 41, Nos. 55, 57, 58 and 59. Schaffhausen, 9, 16, 20 and 23 July 1915.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

Experiments were carried out with 8 different samples of milk to determine the sterilisation effect of the biorisation process (1) and its influence on the characteristic qualities of raw milk in comparison with the effect of weak and strong pasteurisation. Of the 8 samples of milk, 5 were fresh and relatively poor in bacteria, 3 were older and rich in bacteria.

In the experiments the milk was submitted to the following processes: pasteurisation at 65° C. for 20 minutes, at 63° for 30 minutes, at 75° for 30 minutes, biorisation at 70°, 75° and 80° and at a pressure of 2 or 3 atmospheres.

The biorisator and its mode of working is described. Immediately after

(1) See also *B.* June 1913, No. 743; *B.* October 1913, No. 1190; *B.* August 1914, No. 981. (*Ed.*).

each experiment the milk was examined from the following points of view: peroxidase, catalase, time of clotting, reductase, number and species of bacteria, and taste of heated milk.

In the benzidine reaction showing the presence of peroxidase an intense blue coloration was obtained not only for the samples of raw milk, but also for the pasteurised and biorised milk in almost every case. The reaction was negative for a single sample of milk biorised at 80°, and occurred later in two other samples biorised at the same temperature. With regard to the proportion of catalase, the figures were almost always higher for raw milk than for heated milk, in which the proportion diminished with increase of temperature in both processes. No essential difference could be found between the effect of biorisation at 75° and that of moderate pasteurisation.

The coagulating power of milk is not generally diminished to any great extent by heating. Among the samples of the same milk submitted to different processes the sample which required most time for coagulation was the one submitted to a strong pasteurisation. Moderate pasteurisation and biorisation have almost the same influence on the conditions of coagulation of milk, and biorisation at the three different temperatures 70°, 75°, 80° shows least variation in its effect from this point of view.

In determining the percentage of reductase by means of Schardinger's reaction the duration of decolorisation for each increase of temperature in the biorisation was found to increase. The maximum duration of decoloration however was only 24 minutes for biorisation at a temperature of 80°, whilst for milk pasteurised at 70° it was hours. Nevertheless biorisation at 75° only slightly exceeds, from this point of view, moderate pasteurisation at 63° to 65°.

With regard to the bacteriological content of the milk, the effect of pasteurisation was generally somewhat superior to that of biorisation with milk either rich or poor in bacteria. With regard to the species, the ordinary lactic bacteria (*Bacterium guntheri*) survived, also the majority of the micrococci and resting spores of certain soil bacteria. *Bacterium coli* was only found in one or other sample biorised at 70°, whilst *B. aerogenes* which was found in large numbers in several samples of raw milk did not develop in any of the samples.

In two samples out of three pasteurised at 65° for 20 minutes the taste of heated milk was noticeable ; such was also the case for 4 out of 5 samples pasteurised at 70° for 30 minutes. In no case however was this taste noticeable in samples pasteurised at 63° for 30 minutes. With regard to the biorised samples the cooked taste was noticeable on several occasions after biorisation at 80° but never after biorisation at 70° or 75°.

Thus, the biorisation treatment of milk invented by Dr. Lobeck reduces the number of bacteria sufficiently from a hygienic and technical point of view without causing any considerable deterioration in the characteristic qualities of the milk. These results agree with the favourable opinions already published with regard to this process. The same results however may also be obtained by a rational and moderate pasteurisation.

971 - **Influence of Heating Milk on the Natural Separation of Cream.** — BURRI, in *Schweizerische Milchzeitung*, Year 41, Nos 42 and 43. Schaffhausen, May 26-28, 1915.

Five different series of experiments were carried out to determine the influence of heating milk on the rapidity of the natural separation of cream from milk. The results of these experiments are collected in several tables and may be summarised as follows :

1. Of the changes produced in milk on heating to temperatures below boiling point, those which exert an influence on the separation of the cream demand particular attention since they show considerable and easily measured variations for small differences of temperature.

2. These variations may be observed already at temperatures much below the coagulating point of the protein ; for instance heating for 30 minutes at 55° C., and may result in an acceleration or retardation of the separation of the cream according to the particular temperature.

3. Acceleration is distinct at 55° C. and increases with the temperature to a maximum of about 61° C. after which it diminishes and between 63° and 64° C. and probably a little below the latter temperature it changes rapidly and a retardation begins. This temperature can therefore be regarded as the critical temperature for the action of heat on the separation of cream. Heating to 65° for 30 minutes causes a very remarkable retardation in the separation of cream compared with that of raw milk.

The writer points out the desirability from both a practical and theoretical standpoint, of an extension of these researches, in view of the extreme sensitiveness to heat of certain constituents of the milk, so as to obtain information for estimating at their just value the changes produced in milk by any heating process.

By means of a more complete knowledge of this critical temperature it will perhaps be possible to find before long a definite solution on scientific grounds of the question of the best temperature for pasteurisation. Certainly the determination of the rapidity of the natural separation of cream combined with the bacteriological analysis of heated milk will be of the greatest value in examining the various processes for the pasteurisation of milk.

972 - **List of Butter and Cheese Factories in the Province of Quebec.** — *Bulletin No.* 11, *List of the Butter and Cheese Factories of the Province of Quebec.* Published by Order of the Minister of Agriculture of the Province of Quebec, 1915, 75 pp.

A list of addresses of all the factories dealing with milk products classified as butter making, cheese making or both and creameries.

The numbers of the various factories throughout the province are as follows :

Butter-making	636
Cheese-making	881
Butter and cheese making	503
Creameries	35
Total	2 055

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES FOR THE PROTECTION OF CROPS

973 - **Legislative Provisions respecting Diseases of Plants in Egypt.** — *The Agricultural Journal of Egypt*, Vol. IV, Part II (1914), pp. 138-182. Cairo, 1915.

Since the publication in this periodical in 1913 of a list of the agricultural laws then in force in Egypt (1), numerous other legislative measures have been taken in this country, of which the text is now published in French.

The following provisions deal with plant diseases:

1) Order of May 28, 1914.

Single article. — Mangoes coming from India and Madagascar shall be fumigated on arrival at the Customs House.

2) Law No. 4, of June 20, 1914, amending law No. 19 of 1912, treating of the measures to be adopted for the destruction of the cotton-boll weevil (*Earias insulana*).

Art. 1. — To the first article of the above-mentioned law is added a third paragraph to the following effect : Every year, after the picking, all the bolls still adhering to these plants shall be removed and burnt. This operation must be performed at least a fortnight before the date, fixed above for each province, for the pulling up or cutting of the roots of the plants, and in every case before such pulling up or cutting is carried out.

Art. 2. — To article 3 of the above law is added a second paragraph to the following effect : In case of the infraction of the third paragraph of the first article, the plants shall in every case be seized and burnt, whether or not they have been pulled up or cut.

3) Order of August 3, 1914:

Art. 1. — Italy, Greece and Syria are declared infected by a disease produced in trees of the genus *Citrus* by the scale-insect known under the name of *Mytilaspis beckii*.

Art. 2. — All orange, lemon, and mandarin trees coming from the above-named countries, or of unknown origin, and attacked by the said scale-insect, shall be fumigated on their arrival at the Customs House and at the expense of the addressee.

(1) See *B.* May 1914, No. 479. (*Ed.*).

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

974 - **Weather Damage to Rice in Italy in 1915.** — MARCARELLI, B., in *Il Giornale di Risicoltura*, Year V, No. 13, pp. 212-216, figs. Vercelli, July 15, 1915.

During the second half of June 1915, the rice crops throughout the Vercelli district turned unusually yellow, although the general cultural conditions were satisfactory. A chlorotic appearance at this period is of frequent occurrence, and is attributed to the formation of the panicle and the partial arrest of the vegetative developement ; but the phenomenon has rarely manifested itself with the intensity observed in 1915. The outermost leaves became pale yellow and withered at the tips, while the whole plant easily bent over.

In numerous cases, the external leaves and leaf-sheaths present on the portion of the stalk above the surface of the water showed the patches characteristic of *Puccinia oryzae* (1), but there was not sufficient of this to cause the condition observed and the *Puccinia* attack should only be regarded as dependent upon the true cause of weakness of the rice.

Examination of the meteorological data obtained on the experimental ground of the Vercelli Rice-growing Station showed that the period May 27 to June 4 had been marked by a considerable fall of temperature, accompanied by a moisture content nearing saturation (owing to the persistent rains), thick morning mists and clouded sky. The temperature conditions of the air were naturally communicated to the water and soil, with a delay of 1 to 2 and 2 to 3 hours respectively.

The young rice plants, which in the second ten days of May had been exposed to much sunshine and warmth and had shown an early and abundant development, were suddenly subjected to a considerable check in growth, as was apparent from their limited development and a suspension of tillering during the first periods, followed by the yellowing already referred to during the second half of June.

The return of fine weather was not sufficient to eliminate the traces of the adverse circumstances, and as the season was already too far advanced, the young plant prepared itself for the formation of its panicles by partially resuming its normal green colour, but only allowing its tillering and herbaceous growth to exceed by a little the limits they had already reached before the bad weather set in.

The early varieties were the first to show the effects, with reduction of organic resistance and incapacity to put forth new buds ; it was only where the precaution had been taken of draining the field at the right time and applying suitable nitrogenous fertilisers that growth again began to acquire the vigour necessary for a good and abundant formation of panicles, while the entire young plant became possessed of fresh powers of resistance and regained its lost consistency.

(1) See *B.* March 1915, No. 326. (*Ed.*).

975 - **Gumming of Citrus Trees produced by Chemicals.** — FLOYD, B. F. (Plant Physiologist) in *Annual Report of the University of Florida Agricultural Experimnt Station*, 1913, pp. XXX-XLIV, 2 figs. Tallahassee, Florida, 1914.

Many diseases of citrus are associated with the formation and exudation of gum from the injured tissues. Die-back or exanthema is one of these diseases and is thought to be a form of chemical injury induced by certain poisonous products in the soil. In the course of the investigation of this disease, an experiment was carried out to determine the ability of certain chemicals to induce gum formation.

The experiments were carried out on 2-year-old stocks of *Citrus decumana* budded with 5-months-old Pineapple Orange buds in a condition of rapid growth. The various organic and inorganic chemicals were placed beneath the bark or in holes in the trunk or were painted on the surface. Twenty-eight different organic and inorganic chemicals, comprising hippuric acid, succinic acid, indol, asparagine, glycocoll, ammonium sulphate, ammonium phosphate, copper sulphate, sodium nitrate, potassium sulphate, mercury bichloride, silver sulphate, potassium iodide, and an enzyme (malt) were used. Of these, thirteen induced the formation of gum, most of them being classed as acids, alkalis or salts of heavy metals. In the case of the enzyme no gum was evident to the eye, but on cutting the bark and wood there was a slight exudation of gum from the cambium region. The gum-cycle and lacunae showed no difference from those caused by die-back.

The production of gum was always coincident with the injury caused by the chemical. The most copious production was caused by copper sulphate and the other salts of the heavy metals and the injury extended from the point of insertion in the bud or stock to the upper branches. The injury caused by other compounds was confined to the region of insertion. In all cases the gum was of the same clear amber colour and completely soluble in water. Microscopic examination showed that the gum originated in the live embryonic xylem tissue outside the dead area produced by the chemicals, and the gum-cycle was identical with that found in citrus stems attacked by die-back. A study of the weather chart shows that these structures developed during a rainy period and high temperature. Probably a decrease in transpiration at a period when the water absorption is large is favourable to the production of these structures.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

976 - **Fungi of the Island of Luzon, Philippines** (1). — PATOUILLARD, N., in *The Philippine Journal of Science, Section C, Botany*, Vol. X, No. 2, pp. 85-98. Manila, 1915.

About a hundred fungi (Basidiomycetes), collected by C. F. BAKER in the island of Luzon, are here listed. The greater number live on dead or decaying plant organs; many of them are described as new to Science.

(1) See also *B.* June 1912, No. 917; *B.* Jan. 1913, No. 27; *B.* Aug. 1914, No. 787. (*Ed.*).

Worthy of mention are *Septobasidium laxum* n. sp. (on scale-insects on the stems of *Astronia cumingiana*), and *Septobasidium* sp. dub. (on scale-insects on the leaves of *Celtis luzonensis*).

77 - **Species of *Phyllosticta* observed on Plants in Porto Rico.** — YOUNG, ESTHER, in *Mycologia*, Vol. VII, No. 3, pp. 143-150. Lancaster, Pa., 1915.

The writer enumerates a number of species of *Phyllosticta* collected during 1912 and 1913 in Porto Rico and the neighbouring islands of Desecheo and Mona.

P. adianticola n. sp., on leaves of *Adiantum tenerum*.
P. sacchari Speg., on *Saccharum*.
P. panici n. sp., on leaves of *Panicum maximum* Jacq.
P. colocasiae Höhnel, on *Dieffenbachia*.
P. colocasicola Höhnel, on *Colocasia*.
P. commelinicola n. sp., on leaves of *Commelina nudiflora* L.
P. coccoloba Ellis et Ev., on *Coccoloba*.
P. momisiana n. sp., on leaves of *Momisia iguanea* (Jacq.) Rose et Standley.
P. pithecolobii n. sp., on leaves of *Pithecolobium unguis-cati* Benth.
P. pithecolobii-monensis n. var., on the same host.
P. divergens Sacc., on fruit of *Albizzia lebbek* Benth.
P. guanicensis n. sp., on leaves of *Guilandina crista* Small.
P. erythrinicola n. sp., on leaves of *Erythrina micropteryx* Poepp.
P. portoricensis n. sp., on leaves of *Croton lucidus* L.
P. cissicola Speg., on *Cissus sicyoides* L.
P. stevensii n. sp., on leaves of *Triumfetta semitriloba* Jacq.
P. borinquensis n. sp., on leaves of *Helicteres jamaicensis* Lam.
P. bixina n. sp., on leaves of *Bixa orellana* L.
P. eupatoricola Kab. et Bub., on *Eupatorium odoratum* L.
P. eugeniae n. sp., on leaves of *Eugenia buxifolia* Willd.
P. araliana n. sp., on leaves of *Dendropanax arboreum* Dec. et Pl.
P. guareae P. Henn., on *Guarea trichiloides* L.
P. sechii n. sp., on leaves of *Sechium edule* Sw.
P. glaucispora Delacr., on leaves of *Urechites lutea* Britton.
P. ipomoeae Ellis et Kellermann, on *Exogonium repandum* Choisy.
P. pandanicola n. sp., on leaves of *Pandanus* sp.

78 - **On the Resistance of Wheats to Rusts and of Plants in General to Adverse Influences** (1). — COMES, O., in *Annali della R. Scuola Superiore d'Agricoltura di Portici*, Vol. XII, pp. 419-473. Portici, 1914. RESISTANT PLANTS

From the results of numerous experiments taken from the literature on the subject and on the basis of many observations made in practical agriculture, the writer confirms the truth of a principle that he has already had occasion to enunciate several times: namely, that the resistance of plants to adverse influences is in direct connection with the acidity of their sap and with the amount of tannic substances they contain.

(1) See also *B.* July 1913, No. 881. *Ed.*).

After having laid stress upon the importance of the injury caused by rusts and other parasites, and the influence exerted by the variety of wheat as well as the locality and the date of sowing, upon the susceptibility of the plant to rust attack, the writer carefully shows that resistance varies according to the breeds and that it is specific. He then passes in review the experiments made by his school and others regarding manuring, resistance, the acidity of the sap in connection with resistance of the plant, the relation between tannic substances and resistance, selection and hybridisation, the connection between acidity, soil and fertilisers and the resistance of Rieti wheat to rusts ; he finally reaches the following conclusions:

Though the results of chemical analyses can explain the fact which is already well known to agriculturists, namely that the resistance of plants to parasites continually decreases in descending from the mountain to the plain, and in passing from northern to southern regions, especially in hot countries, this result will be of no use to practical agriculture, unless the following objects are attained: 1) to reduce the susceptibility to parasitic attack of the plants that have been improved with so much care ; 2) not to allow a diminution of the power of resistance to parasites possessed by all plants.

In order to obtain the first result, that is to say, to increase and strengthen resistance in the plants most subject to parasitic attack, the agriculturist must make use of biological means only — selection and hybridisation. It is only through selection, or selection combined with hybridisation, that he can determine for a given region the most resistant race for growing in that one region.

With regard to the second point, the agriculturist must bear in mind what has been stated on the important subject of fertilisers, *viz.*, that nitrogenous manuring (especially with dung), while it contributes, on the one hand, in the most direct manner to the improvement of the product, chiefly by stimulating the development of parenchyma, on the other hand renders the sap more sugary, with the consequence of making the plant more susceptible to the attack of parasites.

In order to increase the plants' power of resistance to their enemies, the phosphatic manuring must be increased and the nitrogenous diminished.

All the cultural measures described by the writers (the use of seeds for the multiplication of fruit-trees, the pollarding of mulberry trees as a means of controlling *Diaspis*, and selection and hybridisation for herbaceous plants) are adopted for the purpose of making the plant organism stronger and more resistant. This end will be obtained by enabling the plant to retain its acidity as far as possible, if not entirely. It will be necessary to take care to promote an increase in acidity by suitable retrogressive steps, in order to bring the improved plant back to the required degree of robustness. The economic side of the question must not be lost sight of ; it is for the agriculturist to decide whether he prefers a less refined, but more certain product, or one which is more refined, but more doubtful.

In conclusion, in order to obtain as much acidity as possible in plants, with a view to making them more resistant to adverse conditions, it is ne-

cessary, while allowing the soil to preserve a relative degree of fertility, on the one hand to decrease the nitrogenous fertilisers, and on the other to have recourse to phosphatic fertilisers, especially superphosphates, which should be applied either directly, or by means of green manures. Where it is necessary, from the cultural point of view, to use nitrogenous fertilisers, sulphate of ammonia should be preferred on account of its sulphuric acid, but the amount applied must never exceed 90 lbs. per acre.

All the experimenters have laid stress upon the beneficial effects of superphosphates, which generally strengthen the plants and make them resistant to parasites. This fertiliser is recognised as possessing the property, when used as a prophylactic, of rendering cereals rust-resistant. Its good effect, however, ought to be attributed less to the strength that it gives to the plants, than to the preservation of the acidity of the sap, since the influence of anatomic structure upon the susceptibility of plants has been recognised as being very slight.

In other words, it is not the strength of the tissues that supplies the necessary resistance to parasitic attack and meteorological extremes, but the acidity of the sap, assisted by tannic substances in tanniferous plants.

979 - **Oats Resistant to Rust and Drought.** — See above, No 910.

980 - **Observations on the Behaviour of Direct-Bearer Vines towards Diseases, made at the Conegliano College, Italy, in 1915** (1). — DALMASSO, G., and SUTTO, S., in *La Rivista*, Year XXI, Series V, No. 15, pp. 337-341. Conegliano, August 1, 1915.

About the middle of July 1915 the direct-bearers grown at the Royal College of Vine-growing and Wine-making at Conegliano were examined as to the diseases affecting them ; none of them had received any fungicidal treatment. In the following notes, "mildew" refers to *Plasmopara viticola*, "powdery mildew" to *Uncinula necator*, "anthracnose" to *Gloeosporium ampelophagum*, and "leaf-spot" to *Septoria ampelina*.

Castel 120. — Some berries attacked by mildew ; free from powdery mildew ; anthracnose and leaf-spot virulent.

Castel 1028. — Free from mildew and powdery m. ; some leaf-spot.

Castel 3917. — Free from mildew ; some powdery m. on the bunches.

Castel 4233. — Mildew on the bunches ; free from powdery m., but attacked by anthracnose.

Castel 5009. — Free from mildew and powdery m. ; a little anthracnose and leaf-spot.

Castel 6011. — Free from mildew and powdery m. ; badly attacked by anthracnose on shoots and bunches.

Castel 6030. — Free from mildew and powdery m. ; anthracnose on canes and bunches.

Castel 6606. — Free from mildew ; a little powdery m. on the bunches ; anthracnose rampant.

Castel 7214. — Free from mildew and powdery m. ; some leaf-spot.

Castel 13,317. — An occasional berry mildewed ; no powdery m. ; a little leaf-spot.

Castel 13,320. — A little mildew and powdery m. on the bunches ; some leaf-spot ; setting very poor.

Castel 202,137. — Free from mildew ; slight attack of powdery m. ; some anthracnose and leaf-spot.

(1) See also *B.* June 1911, No. 1899 ; *B.* Nov. 1912, No. 1534 ; *B.* July 1914, No. 686. (*Ed.*).

Couderc 101. — Occasional berries mildewed ; free from powdery m. and other diseases.
Couderc 603. — Free from mildew ; considerably attacked by powdery m. and somewhat b leaf-spot.
Couderc 84-3. — Mildew on the bunches ; free from powdery m. ; badly attacked by leaf-spot.
Couderc 93-5. — Free from all diseases.
Couderc 1305. — Free from disease, but crop almost *nil*.
Couderc 4308. — Free from mildew ; very slight attack of powdery m.
Couderc 4401. — Some berries affected by powdery mildew ; free from mildew ; anthracnos on bunches and buds.
Couderc 74-17. — Free from mildew and powdery m. ; a little anthracnose.
Couderc 82-32. — Free from mildew and powdery m. ; badly attacked by leaf-spot ; no crop.
Couderc 96-32. — Free from mildew and powdery m. ; a little leaf-spot.
Couderc 106-46. — Free from mildew ; a few berries showing powdery m. and a few anthracnose
Couderc 126-20. — Bad attack of leaf-spot ; growth very weak.
Couderc 126-21. — Free from mildew and powdery m. ; badly attacked by leaf-spot.
Couderc 132-11. — Nearly free from mildew (a single bunch near the ground attacked) ; fre from powdery m. ; somewhat attacked by leaf-spot.
Couderc 198-21. — Free from mildew and powdery m. ; somewhat attacked by leaf-spot an *Phytoptus vitis*.
Couderc 199-88. — Free from mildew ; a little powdery m. on the bunches.
Couderc 267-27. — Free from mildew ; powdery m. fairly abundant.
Couderc 28-112. — Free from mildew ; a few berries affected by powdery m. ; leaves badly at tacked by leaf-spot.
Couderc 746-51. — Generally healthy, except for an occasional mildewed berry.
Seibel 1. — Free from mildew; slight attack of powdery m. ; bad attack of anthracnose.
Seibel 156. — Free from mildew and powdery m.
Seibel 1004. — Free from mildew and powdery m. ; badly attacked by anthracnose.
Seibel 1077. — Free from mildew ; a very little powdery m. on the bunches ; a little anthrac nose.
Seibel 2007. — Free from mildew, powdery m., and leaf-spot ; bad attack of *Phytoptus*.
Alicante-Terras 20. — Free from mildew and powdery m. ; bad attack of anthracnose on th bunches.
Jouffreau. — Free from mildew and powdery m. ; some leaf-spot.
Fournié. — Free from mildew and powdery m. ; badly attacked by anthracnose.

The following conclusions may be drawn from the observations so fa made :

1. None of these direct-bearers was much attacked by mildew o powdery mildew, although the season was favourable to these disease and no treatment was applied.

2. The following were absolutely free from both diseases : Caste 1028, 5009, 6011, 6030, 7214 ; Couderc 93-5, 1305, 74-17, 82-32, 96-32 126-21, 132-11, 198-21 ; Seibel 156, 1004, 2007 ; Alicante-Terras 20 ; Jouf freau ; Fournié.

3. Many of these direct-bearers are more or less subject to leaf-spo (*Septoria ampelina*), which is well known to be common on American vines producing redish-brown flecks on the leaves, but without doing appreciabl damage.

4. A number of these direct-bearers are attacked by anthracnose some of them badly ; it should be noted that at Conegliano the condition

are particularly favourable to it, even some native vines being subject to its attacks.

5. The vines most subject to fungus diseases are Castel 120 and Castel 4233.

6. Among the direct-bearers notable for combined high yield and marked resistance to disease at Conegliano are Castel 7214, Couderc 96-32, and Seibel 2007 ; high yield and fair resistance were also shown by Castel 6606, Couderc 4401, Couderc 746-51, and Seibel 1077.

It is satisfactory to note that many of these direct-bearers at Conegliano successfully withstood the exceptionally bad disease season of 1915.

DISEASES OF VARIOUS CROPS

981 – **A Disease of *Hevea brasiliensis* due to *Ustulina zonata*.** — BROOKS, F. T (Formerly Government Mycologist, Federated Malay States), in *The New Phytologist*, Vol. XI, Nos. 4 and 5, pp. 152-164, figs. 1-6. London, April and May 1915.

Early in 1914 the writer frequently saw in the Federated Malay States a disease of *Hevea brasiliensis* which had not before been recorded in Malaya. Preliminary investigation shewed that the trouble was probably caused by a fungus, as hyphae were abundant along the junction of diseased and healthy tissues. The characters of this disease were different from those of the root diseases caused by *Fomes semitostus* (*F. lignosus*), *Sphaerostilbe repens* and *Hymenochaete noxia*, but it was not until towards the end of the year thar the writer was able to find the fructifications of the causative fungus, which proved to be *Ustulina zonata* (Lév.) Sacc. This fungus is the cause of a common root disease of tea in Ceylon, and although PETCH wrote in 1911 that he was not yet certaiu that *Ustulina* attacked *Hevea*, he pointed out in 1914 that several cases of the occurrence of *Ustulina* on rubber had been reported in Ceylon in fields where *Hevea* had been planted among tea. The disease has not yet been recorded on *Hevea* in Java, Sumatra or Borneo.

Ustulina zonata chiefly attacks the collar and root system of old *Hevea* trees (14 to 16 years of age), although a few trees 5 to 6 years old have also been attacked by it.

As the fungus progresses in the collar and root system, the foliage becomes thin and the branches commence to die back; the tree gradually dies unless successfully treated in an early stage of attack.

Fructifications of the fungus appear on dead tissues of the collar and exposed roots ; the fruit-bodies are plate-like in form and grey-brown to blackish in colour.

The writer obtained pure cultures of the fungus with which he carried out infection experiments.

It is probable that the fungus begins to grow upon decayed stumps, from which it passes to the roots of *Hevea* trees; several of the old trees seen to be affected by *Ustulina zonata* were previously attacked by white ants, and it is by no means impossible that the two attacks are connected in some way.

In order to arrest the spread of the disease, it is necessary to attend to it in the early stages, all discoloured tissues being cut out and burnt and the exposed surfaces tarred.

982 – ***Patellina* sp., *Sphæronemella* sp. and *Sphæropsis malorum*, three Strawberry Fungi which cause Fruit Rot.** — STEVENS, F. L., in *Science*, New Series, Vol. XLI, No. 1068, pp. 912-913. Lancaster, Pa., June 18, 1915.

In an investigation of strawberry troubles in Louisiana in 1914, and later in a study of market berries in this State, the fungi described below were frequently found on spotted berries. The diseases were present in so large a percentage of the market berries as to make it apparent that they are real economic factors. In a recent trip to the Louisiana strawberry fields (April 1915), the same fungi were found to be present upon berries still in the fields. The fungi have been isolated in pure culture and inoculations made. It seems desirable therefore to call attention to them at this time. A complete presentation of their study will be made later.

Strawberry fruit-rot due to *Patellina* sp. — This rot begins on either green or ripe berries as a microscopic spot which enlarges slowly in green berries and more rapidly in ripe ones. In ripe berries the spot becomes sunken, the area tan colored ; the margin is quite definite. The surface is soon studded thickly with sporodochia which vary from globular to patelliform or saucer-shaped, usually with a distinct, often wrinkled, sterile margin. In color they vary from hyaline to tan, or when resting on the ripe berry they may take on completely the color of the berry. The core of the diseased spot is completely occupied by the mycelium, rendering it of a spongy tenacious texture. The host cells along a narrow line separating the diseased from the normal area are softened and separated from each other, evidently by enzyme action. It is therefore possible to lift out in its entirety the diseased tissue. The spot in a ripe berry increases in size sufficiently fast to involve the whole of a large berry in about four days. The fungus has been isolated and positive inoculations have been made. It clearly belongs to the genus *Patellina* and appears to be as yet undescribed.

Strawberry fruit-rot due to *Sphaeronemella* sp. — This rot occurs with or separate from the one above described. It differs distinctly in character of spot and is much less rapid in its effects. The spot is not definitely bounded nor is there such evidence of enzyme action as described above. The affected berry soon becomes completely covered with the pycnidia, which are tan-colored to black, distinctly rostrate and are of such a peculiar gelatinous texture that berries affected with this disease can be distinguished by feel. The causal fungus has been isolated and positive inoculations have been made. It is a *Sphaeronemella*, apparently quite distinct from *Zythia fragariae* Laib., and seems to be undescribed.

Each of the above fungi has been found repeatedly on market berries and they are clearly present in sufficient frequency to render them of considerable economic significance.

Strawberry black-rot due to *Sphaeropsis malorum*. — Last year both in Louisiana and in the market in Illinois, berries were frequently found which showed a very peculiar blackening or a bronzed appearance. Such berries rotted down dry and eventually shrivelled. Examination showed the presence of abundant dark coarse mycelium similar to that of *Sphaeropsis*

malorum, and of pycnidia and spores also, as yet indistinguishable from that fungus. This disease was not nearly so abundant as the two above described and is not of much economic significance.

983 - **Vine Mildew in the South of France in 1915.** — PAILLIER, A., in *La Vie Agricole et Rurale*, Year 5, No. 9, p. 159. Paris, July 17, 1915.

The vine-growing region of the south-east of France has suffered in 1915 from the severest attack of mildew (*Plasmopara viticola*) ever experienced by the growers there. In certain districts, and especially in Gard, the losses are enormous, for the whole crop has been destroyed. Hérault and Aude have also suffered, but the writer is of opinion that the damage occurring in these regions is not comparable to that observed in Gard, where, for example, in the fertile plain of the Gardon (which contains excellent land producing, in a well cultivated and manured vineyard, as much as 900 gallons per acre), not only were there no grapes, but there were scarcely any leaves to be seen. This state of affairs will make the injury doubly serious, since the ripening of the wood in such a case takes place under most unsatisfactory conditions ; the grape crop of 1916 will therefore be very seriously compromised.

The writer considers that the causes of the extension and the serious nature of the disease are primarily to be looked for in insufficient spraying, scarcity of labour, the general bad cultivation of the vineyards and, finally, in the exceptionally hot, heavy weather.

It was reckoned that the six departments of the south of France, which yielded over 500 million gallons of wine in 1914, would in consequence of this state of affairs hardly produce half, or even one third, of this amount.

984 - **Vine Mildew in Piedmont, Italy, in 1915.** — MARTINOTTI, F., in *Giornale Vinicolo Italiano*, Year 41, No. 30, pp. 613-615. Casale Monferrato, July 25, 1915.

Serious damage has been done in 1915 by mildew (*Plasmopara viticola*) to the vineyards of Piedmont. The disease has, however, varied greatly in intensity in the various vine-growing zones and in the different vineyards of the same district.

It is probable that some of the crop was lost by bad setting due to the persistent rain during flowering. This rain, alternating with close days, was very favourable to the subsequent development of mildew. The disease was also able to make a serious attack on the bunches owing to the insufficiency of the measures adopted for its control.

The leaves were, as a rule, sprayed with Bordeaux mixture at the right time, so that nearly everywhere the vines have healthy foliage. The treatment of the bunches, on the other hand, left much to be desired ; in many places it was carried out late, and where it was applied at the right time, the materials used were not always of good quality, as has been proved by the analysis of many samples.

985 - **White Pine Blister-Rust (*Peridermium strobi*) in Ireland** (1). — FORBES, A. C., in *Quarterly Journal of Forestry*, Vol. IX, No. 3, pp. 250-251. London, July 1915.

Although common in England of late years, *Peridermium strobi* does not seem to have been observed in Ireland before this year.

A specimen of Weymouth pine (*Pinus strobus*) about six years of age, from Blessingbourne, Co. Tyrone, recently examined, showed the characteristic fruit bodies of this fungus.

At Blessingbourne — the only place in the district where *Pinus strobus* has been planted — the disease appears to have been introduced by young plants from nurseries. It is therefore advisable to obtain the young trees direct from seed sown on the spot.

986 - ***Herpotrichia quinqueseptata* n. sp. Parasitic on *Picea engelmanni* in Idaho.** — WEIR, JAMES R., in *Journal of Agricultural Research*, Vol. IV, No. 3, pp. 251-253, plate XXXIV. Washington, 1915.

Examination of diseased leaves and twigs of *Picea engelmanni* from Marble Mountain, St. Joe National Forest, Idaho, showed the presence of a fungus allied to the well-known parasite *Herpotrichia nigra* Hartig.

The fungus appears to be new to science, and is described as *H. quinqueseptata* n. sp., from the fact that the ascospores always have five septa, while those of *H. nigra* only possess three (2).

WEEDS AND PARASITIC FLOWERING PLANTS.

987 - **Mistletoe on Spruce in Switzerland.** — WILCZEK, E., in *Journal Forestier Suisse*, Year 66, No. 7-8, pp. 113-114, 1 plate. Berne, July-August 1915.

According to the reports of the forest inspectors of French Switzerland, mistletoe (*Viscum album*) is usually not found above 900 m. (3000 ft.), so that the high valleys (valley of Joux, Haut-Jura, etc.) are free from it. In the Valais and the Grisons, mistletoe reaches a higher level.

The list of its deciduous host plants is somewhat long, including Rosaceae, *Populus*, *Salix*, *Alnus*, *Betula*, *Ulmus*, *Fraxinus*, *Tilia*. Amongst conifers, silver fir (*Abies pectinata*) and Scots pine (*Pinus sylvestris*) are mentioned as its chief hosts. On spruce (*Picea excelsa*), mountain pine (*Pinus mughus*), larch (*Larix europea*) and yew (*Taxus baccata*), mistletoe occurs much more rarely. In fact, all the Valais records as regards its presence on *Picea* are mentioned as doubtful in a recent article by Dr. COAZ on the distribution of *V. album* in Switzerland. On larch there is a single record from Monthey.

The writer states that this parasite certainly exists on spruce in the Valais. He has been informed of its presence near Econe and below Nendaz, and has himself found it below Isérables.

(1) See also *B.* Feb. 1913, No. 182 ; *B.* June 1914, No. 577 ; *B.* March 1915, No. 325. (*Ed.*)

(2) These spores are referred by F. J. SEAVER to the genus *Mytilidion*: see note to be published as No. 1093 in the *Bulletin* for October. (*Ed.*)

According to R. KELLER and VON TUBEUF, there are several races of mistletoe adapted to different host trees. Under suitable conditions, the seeds of *V. album* germinate everywhere, but for the seedlings to take root on their host and to grow, it is necessary that the latter be suitable. The commonest race of mistletoe is that found on broad-leaved trees. Seeds from fruit trees will grow well on *Robinia*, poplars, etc., so that this race appears to be general for broad-leaved trees. Nevertheless, even in this case, the beginning of specialisation is observable. Thus, for example, in the plain of the Rhone and at Cully, the common black poplar (*Populus nigra*) is attacked, while the pyramidal form (Lombardy poplar) remains immune.

The conifer mistletoe is very clearly divided into two distinct races. The parasite of Scots pine is especially common in the Grisons and in the Valais. In the canton of Vaud, it is rarer; nevertheless it is abundant from Lavey to Aigle, thus continuing the Valais area. The Scots pine mistletoe can develop, although with difficulty, on spruce; this fact explains the very small number of trees of this species attacked by it. On the other hand, the silver fir mistletoe, which is very common in Switzerland, does not succeed in developing on spruce, and thus constitutes a distinct biological race.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

988 – **Scale-Insects from Australia** (1). — GREEN, E. E., in *Bulletin of Entomological Research*, Vol. VI, Part I, pp. 45-53, figs. 1-13. London, June 1915. GENERALITIES

The following scale-insects from various parts of Australia are described:

Eriococcus serratilobis n. sp., on *Eucalyptus gracilis* at Mallee, Victoria.

E. s. prominens n. subsp., on an undetermined plant at Townville, Queensland.

Rhizococcus lobulatus n. sp. on *Acacia pendula* at Bramble Station, near Condobolin, N. S. W.

R. lecanioides n. sp., on twigs of *Casuarina* at Sandringham, Victoria.

Asterolecanium stypheliae Mask. var. *multiporum* n. var., on *Samolus repens* at Warrnambool, Victoria.

Pulvinaria maskellii Olliff var. *novemarticulata* n. var., on branches of *Hymenanthera dentata* at Mallee.

Chionaspis frenchi n. sp., on *Eucalyptus* at Mallee.

C. angusta Green: recently FROGGATT has described as *C. eucalypti* a species living on *Eucalyptus*, which the writer believes to be identical with his *C. angusta*, originally observed on *Leptospermum*.

Aspidiotus tasmaniae n. sp., on *Ribes* and *Ampelopsis* at Launceston, Tasmania, and on *Eucalyptus*, *Acacia* and *Cytisus* in Victoria.

A. (*Hemiberlesia*) *bidens* n. sp., on *Casuarina* near Lake Albacutya, Victoria.

(1) See also *B.* April 1915, No. 449. (*Ed.*).

A. (*Targionia*) *cedri* n. sp., on *Cedrus* stakes in Queensland.
Mytilaspis (*Fernaldella*) *beyeriae* n. sp., on *Beyeria viscosa* at Mallee.
Protodiaspis anomala n. sp., on bark of *Acacia* sp. at S. Morang, Dixon, Victoria.

989 – **Scale-Insects from the Fiji Islands.** — GREEN, E. E., in *Bulletin of Entomological Research*, Vol. VI, Part I, p. 44. London, June 1915.

The writer has studied a collection of scale-insects made by F. P. JEPSON, Government Entomologist in the Fiji Islands. Although the collection contains no new species, it is nevertheless interesting, seeing how little was known about the scale-insects of these islands.

Most of the specimens are of an *Aspidiotus* intermediate in form between *A. destructor* (Mask.) and *A. transparens* (Green). After having examined a large amount of material from different parts of the tropics, the writer is inclined to consider these two species as extreme forms of the same insect : the intermediate forms, which it is impossible to refer with certainty to the one or the other of the two specific names, are much the commonest. The writer solves the difficulty by giving to all the specimens the name of *A. destructor-transparens* (Mask., Green). This species infects many plants in the Fiji Islands (*Musa*, *Persea* and *Piper*).

The collection further contains: *A. excisus* Green, which had previously only been recorded from Ceylon and has now been found in Fiji on *Musa*, and more precisely on some bananas; *A. cyanophylli* Sign., on *Musa*; *A. palmae* Ckll., on *Musa* and on an undetermined forest tree; *A. lataniae* Sign., on *Citrus*; *A. hartii* Ckll., on *Dioscorea*; *Chionaspis citri* Ckll., on *Citrus*; *C. dubia* Mask., on *Adiantum*; *Hemichionaspis minor* Mask., on leaves of *Eucharis*; *Diaspis pentagona* Targ., on *Hibiscus*; *Lecanium* (*Saissetia*) *nigrum* Nietn., on *Anthurium*; *Asterolecanium miliaris-longum* Green, on *Schizostachyum*.

990 – **The Brown Grape Aphid (*Macrosiphum viticola* Thomas).** — BAKER, A. C., and TURNER, W. F., in *Science*, New Series, Vol. XLI, No. 1066, p. 834. Lancaster, Pa., June 4, 1915.

Unable to find any record of the complete life-cycle of the brown grape aphid (*Macrosiphum viticola* Thomas), the writers have made some observations on the form at Vienna, Va. These seem worthy of note at the present time, in view of the economic importance of the species.

The eggs are polished black and are laid during November or late October ; they are placed in the axils of the leaves of *Viburnum prunifolium* Linn. In the spring they hatch before the leaves open and the young feed on the bursting flower buds. The stem mother appears unlike a *Macrosiphum*, having short cornicles. Late in April, or early in May, the second generation matures and this nearly all becomes alate.

Such alate forms are unable to subsist on the *Viburnum*, but migrate to the grape and produce the third generation on that plant. Here the species lives throughout the summer, producing apterous and alate forms. Intermediates also occur, similar to those recently described by the writers in *Aphis pomi* De Geer. These intermediates were taken in May and June

The fall migrants are unlike the spring migrants in sensory characters. These fall migrants may be found depositing their young upon the *Viburnum* leaves during the middle of October.

The ovipara is apterous and, after being fertilized by the alate male, deserts the leaves and migrates to the twigs in order to deposit her winter eggs.

991 - **Enemies of the Coconut Palm on the Coast of Brazil.** — BONDAR, GREGORIO, in *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de Sao Paulo, Boletim da Agricultura*, Series 16, No. 5 (May 1915), pp. 435-441, 6 figs. São Paulo, 1915.

INSECTS INJURIOUS TO VARIOUS CROPS

The writer gives an account of observations collected on diseases and pests of *Cocos nucifera* on the coast of Brazil.

The coconut palm is somewhat frequently attacked by a bacterial disease, similar to that described by JOHNSTON in the United States and attributed by him to *Bacillus coli* (1). The writer has recorded its presence at Santos, where it has destroyed some of these trees. Certain insects, or rather the serious injury they directly produce by lesions on the host plant, may be considered as agents promoting the spread of the bacterial disease.

Of these insects, the writer mentions in the first place, *Amerrhinus pantherinus* Oliv., a Curculionid which lays its eggs in the petioles of the coconut leaves, in which the larvae subsequently excavate longitudinal galleries, after which the leaves turn yellow and die. Nothing but the destruction of the parts attacked is known to check it. The insect is very common on other palm trees in the State of São Paulo.

Other Curculionids injurious to native Brazilian palms are: *Homalotus coriaceus* Schon., *H. deplanatus* Sahlb., *Sphenophorus ensirostris* Germ., *Rhynchophorus palmarum* L., *Arcarias parcus* Föhrs.; these insects might easily attack coconuts also.

An insect which has already turned its attention to coconuts on the coast of Brazil (Santos) is *Alurnus marginatus* Guér. (*Chrysomelidae*). The larvae devour the young leaves as they begin to unroll, and also find their way into the buds, thus destroying the future leaves; the injury done to the well-developed leaves is no less serious, for the larvae gnaw the cortical tissue of the petioles.

In Brazil, *Cocos romanzoffiana* is attacked by the larvae of *A. 4-macutus* Guér., and of *A. corallinus* Vig.; the latter pest has been observed in the plantations of Bahia, in the Park of the School of Agriculture at Piracicaba.

For the control of these Chrysomelids, spraying with poisonous substances has been used to advantage. The spray must be directed upon the green parts of the trees and especially upon the buds.

(1) See on this subject: *B.* Dec. 1912, No. 1686; *B.* Jan. 1913, No. 40. (*Ed.*).

992 - ***Lecanium catori* n. sp. and *Stictococcus sjöstedti* on Kola Fruits in Northern Nigeria.** — GREEN, E. E., in *Bulletin of Entomological Research*, Vol. VI, Part I, p. 43, 1 fig. London, June 1915.

A systematic description of a new species of scale-insect named by the writer *Lecanium catori*, found in the province of Kabba (Northern Nigeria) on kola fruits in February 1914.

The same fruits were much attacked by another scale-insect, *Stictococcus sjöstedti* Ckll. (1).

993 - **Mediterranean Fruit-Fly (*Ceratitis capitata*) injuring Pears near Paris** (2). — LESNE, P., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. I (1915), No. 16 (July 28, 1915), pp. 495-497. Paris, 1915.

In October 1914 some late pears of very good appearance, gathered at Asnières, Seine, were found to be bored by galleries quite different from those made by codling larvae (*Carpocapsa pomonella*). Each pear contained a single gallery, which was of irregular outline and full of brown gnawed pulp ; there were several Muscid larvae (up to ten) at the end of each.

In the laboratory some of the larvae pupated, but only two emerged, on December 12, when they were recognized as examples of the Mediterranean fruit-fly (*Ceratitits capitata* Wied.).

The land on which the pears were growing is on the plateau of Béconles-Bruyères, close to Courbevoie, where GIARD first recorded *Ceratitis* for the Paris district in 1900 ; at that time the damage was to apricots, the crop being largely destroyed on some farms. In 1906 GIARD noted that *Ceratitis* was still doing damage, peaches being seriously injured in various places round Paris. No doubt the insects now recorded are the descendants of those found in 1900 and 1906.

It would be useful to know how *Ceratitis* passes the winter in France, — probably in the pupal state. At any rate, its apparently permanent presence is a new menace to fruit-growing.

994 - **Citrus White-Fly (*Aleyrodes citri*) on Lemons and Oranges in the Province of Mendoza, Argentina.** — SANZIN, R., in *La Enologia Argentina*, Year I, No. 2, pp. 42-43, fig. 6. Mendoza, June 1, 1915.

The Hemipterous insect known as the white-fly (*Aleyrodes citri*) (3) has spread so rapidly in the province of Mendoza that it is now one of the worst pests of oranges and lemons ; not a single tree seems to be free from its attacks, which lead to the withering of the leaves.

The best means of destroying the insect is to spray in spring before flowering with lime-sulphur or petroleum emulsion. Both these washes destroy the white waxy covering of the insect and so can act directly on it.

The following are the formulae recommended :

(1) See also *B.* July 1915, No. 778. (*Ed.*).

(2) See also *B.* Aug. 1915, No. 878. (*Ed.*).

(3) See also : *B.* July 1911, Nos. 2340 and 2371 ; *B.* Jan. 1912, No. 230 ; *B.* Sept. 1913, No. 1114. (*Ed.*).

Lime-sulphur mixture.

Sulphur	2.8 lbs.
Slaked lime	2.8 lbs.
Common salt	2.8 lbs.
Water	8.5 gallons.

To about a gallon of boiling water add first the sulphur, then the lime and lastly the salt; after boiling for an hour or an hour and a half with constant stirring, allow to cool, syphon off and make up to 8 ½ gallons.

Petroleum emulsion.

Petroleum	$^1/_{10}$ gallon
Soft soap	3 lbs.
Water	10 gallons.

Dissolve the soap in boiling water and add the petroleum, stirring constantly till an even emulsion is obtained.

995 - ***Coleophora albiantennaella* n. sp., on *Cornus* sp. in the State of New York.** — WILD, WILLIAM, in *Entomological News*, Vol. XXVI, No. 7, p. 320, 1 fig. Philadelphia, July 1915.

Lepidopterous larvae found feeding on the undersides of the leaves of *Cornus* at Buffalo, N. Y., are described as new under the name of *Coleophora albiantennaella*. The larvae were collected on June 12 and two adult insects were reared on the 20th and 30th of July.

996 - **Coleoptera injuring Larches in Ireland.** — FORBES, A. C., in *Quarterly Journal of Forestry*, Vol. IX, No. 3, pp. 259-260. London, July 1914.

During the springs of 1914 and 1915 a large number of young larches at Ballykelly, Co. Derry, and Dundrum, Co. Tipperary, were attacked by various beetles; according to the determination of K. B. WILLIAMSON these were *Phyllobius argentatus*, *P. maculicornis*, *Otiorrhynchus picipes*, *Strophosomus coryli* and *Myelophylus* (*Hylesinus*) *piniperda*. Other damage has been recorded from Co. Antrim.

The insects devoured the leaves as soon as the latter appeared. The attack was probably due to the fact that the leaves upon which these beetles usually live were still too little developed to serve as food when the larch leaves began to unfold, so that the latter served to support these insects in the intervening period, at the beginning of spring. In the case of well established trees, little harm was done, but recently-planted larches often suffered severely.

The presence of these parasites on larch appears not to have been recorded before.

ALFREDO RUGGERI, *gerente responsabile.*

FIRST PART.

ORIGINAL ARTICLES

The Present State of our Knowledge of the Biology of the Vine Phylloxera.

by

Prof. B. GRASSI

Professor of Comparative Anatomy in the University of Rome.

I. — FOREWORD.

The ravages that phylloxera has made, and continues to make in all vine-producing countries, render the biology of this insect of particular interest, nor can the subject, even to day, be considered exhausted.

In the second half of the XIXth century, phylloxera was the subject of special research on the part of RILEY, PLANCHON, LICHTENSTEIN, BOITEAU, FAUCON, CORNU and BALBIANI in France, and of FRANCESCHINI in Italy. As a result of these researches, a great part of the biological history of phylloxera was elucidated, but, at the same time, some questions of primary importance, in view of the great difficulty of their solution, still remained unanswered. This I perceived when, in 1906, I was charged by the Ministry of Agriculture to investigate the matter. I immediately began a new series of researches which I continued later with the able collaboration of Drs GRANDORI and TOPI, and especially with that of my assistant Dr ANNA FOÀ. The French entomologists MARCHAL and FEYTAUD (1912) have been so kind as to say that my collaborators and myself have made an important contribution to this study, that we have discovered new facts, modified antiquated opinions and solved certain problems that our predecessors had but dimly perceived. Two years had passed since the commencement of our researches, when the study of this same subject was entrusted by the German Government to Dr C. BÖRNER, well known among naturalists for his important researches on forms allied

to phylloxera. The results obtained by this distinguished zoologist, largely confirm those published by us in various notes and more extensively treated in our larger monograph, which this worker has flatteringly termed "a monumental work". Dr BORNER himself has brought forward an original and interesting theory, which, however, is as yet unsupported by experimental evidence.

It is with these new facts that I intend to deal, but before doing so, I must, in order to make myself clear, recapitulate very briefly the ideas current on this subject at the beginning of our researches.

I state beforehand that, following the laws of priority, the name of *Phylloxera vastatrix* should be replaced by that of *Viteus vitifolii* (Fitch), or *Phylloxera* (*Viteus*) *vitifolii* (Fitch), but I do not feel disposed to adopt this change, excusing myself with the words of Horace : *usus quem penes arbitrium est et jus et norma loquendi.*

II. — KNOWLEDGE OF THE BIOLOGY OF PHYLLOXERA PREVIOUS TO 1905.

The short summary of information here given is more or less to be found in the best treatises on the subject prior to the new researches and is due for the most part to BALBIANI, to whose talent the investigations on the biology of phylloxera are further witness.

Phylloxera, like other insects, before assuming its ultimate form passes through several moults each of which marks the passage from one stage to another. The various stages take different names. Larva, when the immature insect shows no trace of wings. Nymph, when, still immature, the outlines of the wings are visible. Perfect insect, when capable of reproduction, whatever its outward appearance. But phylloxera, differing from the majority of other insects, may enter the perfect stage under various forms, of which four are recorded ; the gall form (gallicola), the root form (radicola), the winged and sexual forms. As will be noticed, these names are not founded on considerations of similar character. The two first are derived from the insect's habitat, the third from its external appearance, the fourth from the manner of its reproduction ; in other words, each form has been named according to its salient character. The gallicolae alone live on the green parts of the vine, especially on the leaves, on which they produce excrescences known as galls ; only the radicolae pass their entire existence on the roots. The term of winged form serves to distinguish a form that originates on the roots, thence flying up to the higher parts of the vine, while the other three (radicola, gallicola and sexual) are apterous. Thus only one form is called sexual, because it is the only one in which males and females are distinct; the latter, after fertilisation has taken place, lay a single egg, whilst the other three forms consist exclusively of individuals of the female sex which reproduce parthenogenetically by means of a few or a number of eggs.

To attain these several forms, the authors say that phylloxera passes through a variable number of stages. They attribute three moults to gall-

olae and radicolae, five to the winged form and none to the sexual. Were this actly so the winged form might be considered as the only mature, perfectly veloped form, and the others might be easily defined as larval forms be-me sexually mature. But we shall see it is not precisely so.

Let us now recapitulate the history of phylloxera. We learn from books at from the single fertilized egg, laid by the sexual female and called urable, or winter egg, because it only hatches in the spring, a larva emerges hich may take to life either on the leaves or on the roots. Usually, on uropean vines, it prefers the roots. In both cases this larva is destined become a wingless mother (generally known as the stock-mother). If it kes to the leaves, it gives rise to a number of generations (sometimes as any as eight) within galls (gallicolae); if to the roots, to innumerable enerations of radicolae (sometimes seven or eight, but usually four, five x annually).

Each gallicola mother lays hundreds of eggs, and as these hatch, the oung, emerging from the maternal gall go to form one for themselves ometimes several mothers of different ages are found in one gall) when ey reproduce in the same way, or they may descend to the roots where ey found radicola colonies. As the season advances, the number of young ssing on to the roots increases till finally all migrate to that part of e plant. Only in exceptional cases are gallicola generations found on uropean vines; which means that one of the most characteristic gen-ations of phylloxera may be entirely lacking. In summer and autumn, mphs appear on the roots; these develop into winged insects which lay eir eggs, male and female, under the vine leaves or in the crevices of e bark of the trunk and branches (not of the year). The fertilized nales lay the winter eggs in the same places, much preferring, however, e two-year-old branches.

To sum up, the stock-mother, the other gallicolae and the radicolae in the rfect insect stage, are all parthenogenetic mothers (i.e. capable of reproduc- without being fertilized) and virginiparous (bearing offspring capable, e the mother, of reproduction by parthenogenesis); the winged insects parthenogenetic mothers but give rise to sexual individuals, the offspring these sexual individuals being a parthenogenetic virginiparous mother ock-mother).

This cycle may be completed from the spring to the following autumn· wever, in the height of winter, the winter egg is not the only stage exist-, as a number of radicolae may be found in the first larval stage which pass cold season hibernating on the roots and begin to multiply afresh in the owing spring. This occurrence obviously enables the phylloxeric infec-n to continue independently of the winter egg.

Here arises a serious question that has long hampered both science and ctice. With the approval of the discoverer of the life cycle of phyllo-n, BALBIANI himself, evidently imbued at the time with the theoretical ceptions then dominating science, it has been assumed that the virginal erations could not be perpetuated without the interposition of sexual erations. This assumption undoubtedly appeared to be supported by the

fact that in the various forms which succeed one another in the life-cy of phylloxera, prolificacy diminishes progressively. Gallicolae and radico are both very prolific, the former, on the whole, more than the latter; a matter of fact, while the gallicolae derived from the winter egg may 500 eggs or more, the radicola never reach so large a number, but most 250. The winged forms lay at most a dozen either male or fem eggs. The sexual female lays a single egg, the winter egg. It may be ad that gallicolae, and also in general radicolae, lay fewer eggs in autumn than in the spring.

If fertilisation were really necessary to preserve the reproductive po of phylloxera, it would have sufficed to destroy the winter egg (the only fertilized) to have mastered and, finally, after a longer or shorter per to have destroyed phylloxera completely.

The theoretical conclusion of BALBIANI was of too much practical portance to be neglected, and it was immediately put to experimental t The result was directly opposed to what BALBIANI expected, for BOITE succeeded in breeding phylloxera in closed recipients — thus excluding his opinion the intervention of sexual forms — for six consecutive yea and up to the 25th generation, without ever having noticed any di inution in the reproductive power of the colonies.

At the same time, by BALBIANI'S advice, the winter egg was destro on a wholesale scale by plastering the stocks with insecticide, but notwi standing this destruction the plan for freeing the vines from phylloxera with no success. This failure was not, to my knowledge, openly publish I believe out of consideration for BALBIANI'S authority.

The results obtained by BOITEAU might have been explained by the s position that in a state of nature things went otherwise than in the exp mental vessels; or even by supposing that in the vessels sexual generati occurred that had escaped the observer's notice. The latter view may supported by the fact, observed by BALBIANI (but never confirmed by a one else) of sexual individuals existing on the roots; by the presence of winter egg on the roots recorded by FATIO (probably an error of obser tion) and finally by what happens in the case of the oak phylloxera existence of apterous sexiparous individuals).

It still remained to ascertain the reason why European vines sh galls only in exceptional cases.

The supposition that the product of the fertilized egg might in cert cases pass directly on to the roots was easily accepted, probably becaus did not diminish the importance of sexual generation.

It is true that BALBIANI, who at first was of the opinion that the wi egg could produce either a gallicola or a radicola, had subsequently exclu the second possibility, and that BOITEAU and FRANCESCHINI who had t experimentally to attach the larva, hatched from the winter egg, to the ro had met with no success; but all this went for nothing. BALBIANI'S reca ation found no credence and the experimental failures were explained by scarcity of material used. Thus, the direct passage of the insect, after hat ing from the winter egg, to the roots, was accepted as a "scientifically

monstrated phenomenon " by HENNEGUY (1904) collaborator of BALBIANI and continuer of his researches, by FRANCESCHINI himself, by DEL GUERCIO (1902) pupil of TARGIONI and Director of the Entomological Station of Florence, by the Germans RITTER and RÜBSAAMEN (1900) etc. etc. and, little by little, found a place in every book. And yet it had not been proved by experiment, but, as has already been said, a certain amount of evidence had been obtained to contradict it ; still the idea held its own above all discussion, evidently again owing to the respect for BALBIANI'S preconceived theory. Since BALBIANI'S time, however, the theory of the absolute necessity of sexual reproduction for perpetuation of life has gradually lost ground, and might be said to have been completely disposed of when our researches were begun. Besides the common case in which reproduction is only possible when preceded by fertilisation, other cases are known. Those in which virginal and sexual generations alternate regularly, those in which the two manners of reproduction alternate in a variable or facultative way, and finally, those in which the preservation of the species is confined to virginal reproduction alone. It follows, therefore, that no *a priori* deduction as to the importance of the winter egg for the preservation of phylloxera can have a decisive value, and that objective research alone can solve the problem.

It was with experiments along these lines that our work was begun.

III. — MODIFICATIONS OF OUR KNOWLEDGE OF THE BIOLOGY OF PHYLLOXERA DUE TO RESEARCHES MADE SINCE 1905.

1. *Fate of the winter egg and of the generation derived from it.* — The principal obstacle encountered by my predecessors in their attempts to determine the fate of the newly born insects derived from the winter egg, which prevented them from repeating their experiments, was the difficulty of obtaining sufficiently abundant material for the results to be definite and conclusive.

After fruitless attempts in continental Italy, I had the happy idea of extending my researches to Sicily, and in the nurseries of American vines at Palermo, Modica and Messina, I was able to obtain as many winter eggs as I could wish, and thus found myself in the most favourable conditions for experimental work.

The experiments I made with the aid of my collaborators were extremely numerous, and were repeated for several years under the most varied conditions. They consisted chiefly in placing bark containing a very large number of winter eggs — special precautions being taken to prevent their dying — in contact with uninfected European vine stocks, and also with healthy American vine stocks to act as controls. In spring, there appeared on the American vines numerous primary galls (I call " primary galls " these produced by the stock-mother) which proved that the winter eggs had remained alive. The European vines, on the other hand, were almost always totally exempt. The roots of both kinds remained invariably, without exception, uninjured

(that is until the appearance of the neogallicolae-radicolae ; see below). It has thus been proved in the most definite manner that in no case can the insect newly escaped from the winter egg live on the roots. If it has the chance of migrating to the young leaves, or to other green parts of the American vine adapted to it, by means of its punctures it determines the formation of a gall and here, after having completed four moults (FOÀ : see below), becomes sexually mature and lays its eggs. But, if instead, it finds itself on the green parts of European vines, or of certain American vines (I include under this head also European-American hybrids) not adapted to its existence, it punctures but does not succeed in producing a gall and dies (1).

It is necessary to note that the same sorts of vine do not always behave in similar manner. Even on the European vine, in certain very exceptional cases (2), which we were able to verify in a state of nature only in Sicily, near a nursery of American vines which bore numbers of galls — the newly hatched insect from the winter egg was able to produce more or less perfectly formed galls. That the case is really very exceptional is amply confirmed by the fact that, in the numerous and repeated explorations made, for so many years, by the anti-phylloxera parties, never has a European vine been found bearing galls that could have possibly, directly or indirectly, originated from the stock-mother hatched on the plant, that is to say galls produced independently of American vines bearing galls. It is well to remember here that when European vines are in contact with heavily galled American vines, in the latter part of the season they are sometimes infected, but in this case the infection is evidently produced by the neogallicolae-gallicolae derived from the American vines themselves.

The phylloxera gallicola arising from the fertilized egg (briefly termed the stock-mother) lays, as we have said, an enormous quantity of eggs over a period lasting about a month ; each egg hatches in eight to twelve days. Individuals from eggs of the first few weeks all make their way to the leaves,

(1) The traces of these punctures remain : they consist of small black spots that may be produced not only by the insect newly escaped from the winter egg, but also by all neogallicolae-gallicolae (see below). These little spots, which we were the first to notice, are somewhat characteristic and therefore deserve particular mention. They appear on the most diverse American varieties and also on our Italian vines : we have followed their production more especially on the leaves of Rupestris du Lot. On this vine, in some instances, regular galls are produced, at other times a gall is started and abandoned almost immediately, or again, the gallicolae will leave and die (always ?) without starting a gall, except for a small depression of scarcely noticeable depth (some gallicolae may even die on the spot). The three cases may occur on the same stock contemporaneously. In the second and third cases brown spots more or less fused together quickly appear ; these delimit a more or less regular and more or less complete circle of varying size but quite visible with the aid of an ordinary lens ; this is explained by the fact that the phylloxera makes a series of punctures forming a circle in order to produce either the gall on the leaf, or the nodosity and the tuberosity on the root. The space delimited by the circle also turns brown after a few days and ends by becoming a small black spot, which, when fully developed on the leaf, does not cover more than a millimeter and a half.

(2) Less exceptionally on European vines grafted on an American stock.

where they possibly develop. Those from eggs of a later period pass to the roots; these, however, are generally few in number.

It is a very remarkable fact that the settling of the newly hatched individuals on the hypogeal rather than on the epigeal portion of the plant is not only a matter of choice, but is connected with the presence of easily identifiable morphological characters, so that the destination of the newly hatched individual may be deduced from its appearance. We have therefore thought it opportune to assign different names to the two kinds of newly hatched individuals (or "first larvae", as they might be called, to show that they are in the first stage and have not yet undergone the first moult). We shall therefore apply the name of *neogallicolae-gallicolae* to the newly hatched females of gallicolae that will, in their turn, become gallicolae, and that of *neogallicolae-radicolae* to the newly hatched females of gallicola that will become radicolae. With the naked eye, no difference can be observed between them, but on examining a preparation merely with a hand-lens, it can be seen that the neogallicolae-gallicolae are smaller, lighter in colour, and slighter, their legs and especially their antennae being relatively thinner. The neogallicolae-radicolae, like the neo-radicolae — as we call the newly hatched females of radicolae — have a more robust appearance. This very superficial diagnosis would not of itself be sufficient proof, but all doubt vanishes immediately a microscope is used. In the neogallicolae-gallicolae the antennae are thinner, the third joint being fusiform and the sensory organ still relatively small, while in the neogallicolae-radicolae and the neoradicolae the antennae are thicker, the third joint is shaped like the mouthpiece of a flute, and the sensory organ is very large. Other minute but quite distinct differences result from the comparative study of the hairs on the legs and antennae, and of the cuticle of the dorsum (GRANDORI). An important point is that the bristles of the rostrum in neogallicolae-gallicolae never extend as far as the last segments of the abdomen; on neogallicolae-radicolae and on neoradicolae they may, in the spring, be just slightly longer than those on neogallicolae-gallicolae, but in late summer and autumn they may exceed them in length by as much as a third (FOÀ).

We must admit that there also exist individuals which may be called intermediate, but it is extremely rare for them to be equally distant from the two typical forms; they generally resemble one more than the other and their history naturally follows that of the one which they resemble most. In any case, the newly hatched insect which emerges from the winter egg presents all the typical characters of a neogallicola-gallicola; thus affording a splendid confirmation of experimental results.

The most important practical consequence of our observations is that the newly hatched insect from the winter egg does not develop on European vines. Exceptional cases are so rare that they may be practically neglected.

We have already pointed out that among the latest offspring of the stock-mothers may appear some neogallicolae-radicolae, but these are not always capable of reproduction; they are absent when the stock-mothers develop with difficulty and lay only a few eggs, which happens, for example, on non-grafted European vines, when they — and the case is most exceptional —

produce galls. On European vines grafted on American stocks, neogallicolae-radicolae sometimes occur, the offspring of a stock-mother. The appearance of neogallicolae-radicolae has been observed in Sicily during the last ten days of May; at this period the first neogallicolae of the third generation (counting that of the stock-mother as the first) are found. On European vines even when grafted, the development of the gallicolae is slightly retarded.

As the number of generations increases the quantity of eggs laid by the gallicolae, becomes, as is well known, gradually smaller, and simultaneously, by observing the single newly hatched individuals that emerge, the proportion of neogallicolae-gallicolae to neogallicolae-radicolae may be seen to decrease. It has been shown by a series of experiments that, when the egg of the gallicola is laid, the type of larva to which it will give birth is already determined; external conditions (season, vine, and others not yet specified) exercise, on the other hand, an influence on the mother, in the sense of changing the relation between the number of eggs that will develop in one particular way or the other. It may be stated as a general fact that neogallicolae-gallicolae are born in greater numbers when the vine is in a state of active growth, while neogallicolae-radicolae are almost exclusively produced when the season is advanced and, in general, when the vine no longer produces any new leaves, or has practically ceased to do so. By transporting, artificially, neogallicolae-gallicolae from one plant to another, the production of an offspring may be obtained in which the proportion between neogallicolae-gallicolae and neogallicolae-radicolae differs from that encountered in the sister neogallicolae-gallicolae remaining on the original vine.

While the neogallicolae-gallicolae can never develop on the roots, exceptional cases may occur where an occasional neogallicola-radicola enters or remains emprisoned in a gall. In such cases it matures as on the roots, either in an apterous form, developing the dorsal tubercles, typical of the hypogeal radicola, or in a winged form, identical with that which commonly develops on the roots. A neogallicola-gallicola will never develop wings (Topi, Börner); therefore the winged forms, which others, and we also, have occasionally found in galls, do not represent the winged form of phylloxera-gallicola, but are merely winged radicolae developed in exceptional circumstances in an environment not habitual to them.

The parallelism that Franceschini had thought to have established between the cycle of phylloxera gallicola and that of radicola on the supposition that both could produce winged forms and consequently also sexual forms and the winter egg, is therefore not admissible.

It is also erroneous to assert, as does Del Guercio, that phylloxera gallicolae can, after the first generation, produce winged forms and that these, in their turn, immediately producing radicolae, find hospitality on the roots of every sort of vine. These winged virginiparous insects in the gallicola series of the vine phylloxera would be redoutable agents in spreading infection, but fortunately they have never existed.

It may be as well here to mention various mistaken opinions that have

n enunciated from time to time as to the gallicola form, and that may now definitely eliminated.

Salimar (1869) and Donnadieu (1887) had maintained that the gallicola m was a separate species, distinct from radicola; Donnadieu, indeed, had n given it a name (*Ph. pemphigoides*). This extraordinary assertion had found much acceptance, and when we began our researches had even been ıted by some, Ráthay, for instance ; others, however, were not lacking o found it merited consideration, or quoted it without stating it to be oneous. It is needless to add that after our own researches, there is no ther reason for its existence.

Del Guercio (1908) announced (on no sound basis of observation) the stence of phylloxera with the gall-forming capacity, and of others without h capacity, therefore concluding that in a locality where only the latter are nd, it is unlikely that gallicola can appear unless they be introduced. The y fact that might give possible foundation to this assertion is that in ny places attacked by phylloxera, gallicolae do not appear till after a lapse several years. But a careful study of the various cases in which such a enomenon was observed, has led to a conclusion contrary to that of Del ercio. In Sicily, for instance, according to what was ascertained at my gestion, by the late lamented Professor Ruggeri, gallicolae appeared on erican seed-vines in 1887, before which epoch no American vines had been orted into the island, the few that already existed all being derived from nts sown locally. Ruggeri himself concludes that, with these facts in nd, even apart from the position of the place, widely removed from any sery, no doubt remains as to the origin of the first galls he observed vidently caused by the pre-existing infection on European vines, and most tainly not by gallicolae introduced into Sicily by means of American vines".

Something of a similar nature was observed also in the island of Elba. va here searched in vain for galls until 1908, in which year he found them the first time in the plantations of the Portoferraio nursery, and only on e stocks. This form of infection, therefore, in this case also, became arent eleven years after the first plantation. As it is certain that no d had been introduced into Portoferraio during these latter years from lities where galls existed, the conclusion must be drawn that in this case ell the galls originated from colonies of phylloxera which, for a number ears, had had no opportunity of producing them.

In Apulia, where the infection dated back fifteen years or more, icolae were first observed in 1914, and there can be no question of im- ation. These facts are difficult to explain, the more so since once the s have appeared, they recur regularly (not always, as is believed by some) ubsequent years. Undoubtedly the phenomenon is influenced by the city of winged forms, and by the lack of American vines with a sufficiently loped stock (1), but these factors do not seem sufficient.

(1) It is not exactly true that winter eggs are found preferably on two-year-old-wood ; in they often abound on older wood, whilst they are completely absent from the two year ood in which the cortical layer has no crevices aud is completely adherent ; that is to say in dition which does not favour egg-laying on the part of the phylloxera.

Probably the late appearance of the galls is connected with the f
that in the locality where American vines are relatively scarce and you
winter eggs are more easily found on the European vines (BOITEAU) (1). I t
it that where there are still numerous European vines, the winged inse
become very easily dispersed, and that this is the chief reason for the belat
appearance of the galls.

Further, laboratory devices are known and used both by ourselves a
BÖRNER, by means of which galls may be provoked in any locality, whe
in spite of many years infection by phylloxera they have not previou
existed, and this without introducing phylloxerae from outside. It suffic
for example, to develop from nymphs (collected in any manner) a quant
of the winged insects in a hothouse where receptive American vines, w
sufficiently large stocks, are growing.

There is therefore no ground for attributing a gall forming capacity o
to certain phylloxerae.

2) *Importance of the winged insect for the spread of phylloxera
European vines.* — We have seen that the product of the winter egg on E
ropean vines, in the great majority of cases — we might practically s
always — is destined to perish. We know that the winter egg is the o
egg laid by the sexual forms, and that the sexual individuals can only be bo
from the winged insects; it follows that the winged insects also, contrary
the belief of most authors, may be considered non-existent as regards t
spread of phylloxera on European vines. The winged insects form, ho
ever, a danger as regards propagation when it is possible for them to lay th
eggs on American vines also capable of bearing galls. Recollecting, the
fore, that the winged insects are almost always either entirely male-produci
or entirely female-producing, a single casual visitor to a vine even if t
latter be receptive cannot be supposed capable of infecting it.

The question had never been stated in anything like the above ter
when TARGIONI-TOZZETTI and FRANCESCHINI regarded the danger offered
the winged insect as being limited, and they supported their view by reaso
which were subsequently proved to have little or no foundation. For e
ample, in 1880, TARGIONI wrote that the significance of the winged insect
Europe for European vines should be regarded rather as hypothetic than
scientifically proved and that, with us, the winged insect itself could only
a representative form incapable of producing any real effects. He came, ho
ever, to this conclusion from the assumption (often incorrect) of the scarci
of winged insects and from the difficulty of finding the sexual insects and t
winter egg. TARGIONI who, as regards phylloxera, made very few research
of his own, argued from data furnished by others. FRANCESCHINI,
the contrary, made many personal observations, generally confirming f
northern Italy the observations made in France. He noticed, amongst oth
things, a prolific development of the winged form from the end of June

(1) It must be remembered that in northern countries the winged insect prefers to lay
eggs on the leaves, and in southern countries on the bark. Possibily the sexual ova on the lea
are for the greater part lost.

e end of September, from the roots of both Italian and American vines. owever, he did not attach much importance to them, saying that, for arious reasons, it was unnecessary to exaggerate their influence on the pread of phylloxera.

He drew special attention in his publications to the fact that the winged sects do not voluntarily leave the vines on which they have developed. 'e, on the other hand, have observed that FRANCESCHINI's own data regard- g the capture of the winged insects on panes of glass smeared with glycer- e, do not in the least prove that the winged insects only leave the vines very small numbers. We have observed that the winged insects fly in earch of suitable vines for laying their eggs, guided thereto probably by some factory sense infinitely finer than that possessed by us. This is proved by ne way in which they know how to find and reach the bark of stocks belong- g to a special kind of vine, even though these be very low and entirely idden by an abundance of foliage, while these same stocks no longer attract nem to lay their eggs when the green tops have been lopped off (TOPI). The egree in which the winged insects leave the place where they have developed robably varies according to the greater or lesser proximity of the suitable ines; if in favourable surroundings they may therefore wander very little. LORITZ wrote in 1883 that when the winged insects reach, during their mi- ation, the highest part of the vines, that is, the parts most exposed to the ght, they fly away, and in such cases, when not carried upwards or away by current of air, they quickly alight on the leaves of the neighbouring vines, ne reason being because of their tendency to fly downwards and obliquely. 'e, too, have observed that the winged insects fly towards the parts which e most strongly illuminated and whence the wind easily blows them away t we consider that when they remain clinging to the under side of the leaf, more or less hidden in the bark, they are already preparing to lay their gs, and, consequently, no longer seek the light but a shelter from the air rrents that might possibly carry them off.

They may be seen flying about on warm damp days when the sun is ttest. There are a number of reasons for supposing, as I have already entioned, that among European vines they easily become dispersed and astray.

FRANCESCHINI has also maintained that very few of the winged insects ys eggs, and that even when they do, such eggs do not hatch. This obser- tion has no general value because, at Messina and Palermo, for instance, rtile sexual forms are found in large number and their eggs hatch without ficulty. As a matter of fact, the sterility of the winged sexiparous forms probably governed by unfavourable conditions in the environment, which y exist in some years and not in others.

On the other hand, even in northern Italy, galls are anything but rare places where there are strongly receptive vines (Clinton, Vialla, etc). is leads us to suppose that although our actual researches have only ealed very limited numbers of fertile sexual forms, sexual eggs which tch out, and winter eggs, they must in reality be considerably numerous. As swarms of winged individuals are immense, it is easy to understand that

the absolute number of fertile individuals must be large, though their percentage be small. Had the insect newly hatched from the winter egg found if possible to settle on the roots, then the winged insects would have certainly formed a fundamental factor in the spread of phylloxera on European vines. Thus, although TARGIONI and FRANCESCHINI did attempt to discredit what they described as the "fearful prestige" of the winged form, their grounds for doing so were totally different from ours. As a matter of fact, we have shown and BÖRNER has amply confirmed, that contrary to what FRANCESCHINI asserts, the insect newly hatched from the winter egg cannot pass on to the roots, and can never (or practically never) develop on the leaves of European vines. These are the reasons that deprive the winged forms of any importance in the infection of such vines.

Again, as regards the winged forms, as has already been done for the gallicolae, I must correct en error which still appears in some publications. It has been repeated over and over again that the winged forms might be of two kinds; thus STAUFFACHER, in 1907, believed he was able to distinguish winged virginiparous and winged sexiparous forms, the first being devoid of and the second possessing a special organ of static sense which he described in detail. In no case does such an organ exist and the author has mistaken and described a stigma which is invariably present. The winged forms of vine phylloxera are all sexiparous, and no distinction into two separate kinds is ever possible unless it is wished to consider as such sexiparous forms which produces males, and those which produce females.

3) *Nymphal forms.* — The necessity of sexual reproduction in the cycle of the vine phylloxera could not be wholly and definitely excluded while the existence of sexiparous forms was still regarded as possible. Such sexiparous forms are definitely known to exist for the various oak phylloxera, including the root form we ourselves discovered. They show various forms intermediate between the apterous and the winged form, but, as externally they generally resemble nymphs, frequently showing the traces of more or less developed wings, we have called them "ninfali" (nymph-resembling forms). They naturally differ from nymphs in laying eggs.

Three nymph-resembling individuals ("ninfali") had been observed by MORITZ who described them as monstrosities. We have ascertained that "ninfali" are common on American vines which produce numbers of winged insects. Like those belonging to oaks they have sometimes no trace of wings and resemble closely the apterous forms, from which they can be distinguished only by means of their eyes which are similar to those of nymphs, that is, they possess more than three facets, and sometimes also by means of the slightly greater length of the antennae. Other "ninfali" have rudimentary wings like those of nymphs, very long antennae, eyes composed of numerous facets, etc. We have collected a considerable number of "ninfali" and have obtained their offspring, being thus able to demonstrate that their eggs develop like those of apterous radicolae and do not give rise to sexual individuals, consequently excluding all possibility of a sexual generation independent of the winged insects. It has thus been shown that to the four forms of phyl-

oxera capable of laying eggs, or definitely adult, mentioned by the authors already quoted, a fifth must be added, the nymph-resembling form (1).

4) *Radicolae*. — The principal contribution made by our researches to the knowledge of radicolae consists in the demonstration that the fate of their eggs, contrary to what has been seen for gallicolae, is not determined at the moment of oviposition, nor is that of the first larva. From a larva of radicolae may be evolved either an apterous radicola or a winged form, according to the influence of the environment. This might also be surmised by considering that, on American vines (for preference) winged forms develop in very considerable numbers, that they are also produced in large quantities on the nodosities of European vines (for instance in North Italy) whilst on the European vines of the Pisan hills they are everywhere very rare, and in certain years extremely so.

We have, however, also furnished experimental proof. If, from an American vine, two rootlets are taken covered with first larvae already adhering to them, and one is left intact, and from the other all the larvae are removed except one, and the rootlets are then placed in a receptacle and carefully kept alive until the phylloxerae have reached maturity, the isolated larvae will always be observed to develop into apterous forms, whilst those remaining together develop for the greater part into winged forms. By means of similar oft repeated experiments, we have become convinced of the double power of the first larvae, which has also been confirmed by BÖRNER. After hibernating, however, they never become winged; that their female off spring may do so is very probable and is admitted even by BÖRNER, but is not as yet definitely proved.

5) *Emergence from the soil of the first larvae*. (2) — Our very latest researches have shown that in infested vineyards, enormous numbers of phylloxerae rise to the surface of the soil, where they run about like ants. These are almost all newly hatched from the egg (newly-born or first larvae).

This phenomenon was first observed by FAUCON (1868) and was confirmed by some investigators, but considered by others to be doutbtful and of mediocre interest. FRANCESCHINI especially, has repeatedly written that whilst FAUCON relates that he has often observed larvae moving about on the soil, evidently in search of juicy roots with the thermometer on the ground registering 142 degrees", he himself, though repeatedly working under a baking summer sun, examining the soil of badly infested vineyards for hypogeal phylloxerae in course of migration from one vine to another, has never succeeded in seeing a single one (3).

In Italy the phenomenon was thus neglected and forgotten. This was

(1) It may be stated here that the nymph-resembling form undergoes the same number of moults as the other forms, and that the number of these moults, contrary to what the authors say, is four in every case, even for the winged and sexual forms (FOÀ). (*Ed.*).

(2) See *B* Oct. 1914, N. 966.

(3) "The phylloxera has legs for crawling and wings for flying... but crawls and flies little" (FRANCESCHINI).

also the case in other countries, and the principal reason was the conviction that phylloxera was spread chiefly by means of the winged forms, and that it was therefore not worth the trouble to pay any attention to another agency which in comparison with the first, seemed to offer less danger, was badly confirmed, doubtful, and considered to have no general or constant application, Having eliminated the question of the winged forms for European vines, we wished to return to FAUCON'S observations in order to make certain that the migrating first larvae might not produce the damage which could no longer be ascribed to the winged forms.

Our researches led us to discover in these migrations a phenomenon vastly more important than we had supposed.

First of all, we have been able to observe without difficulty numerous newly hatched phylloxerae crawling along the edges of pots in which phylloxera infected vines were growing. A similar thing is also observed on the edge of glasses containing infested roots covered by a small quantity of earth. With more inconvenience but with equally positive results, our observations were repeated in the vineyards. By lying at full length on the ground near an infested vine, it is possible by careful examination, with the help of a lens if necessary, to see newly hatched insects wandering about on the cracked surface of the ground, identical with those found on the roots. The first stock chosen may perhaps not be a good one, and it may be necessary to change one's position, but usually not many minutes elapsed before some phylloxerae strayed into our field of observation. The search is facilitated by teaching a boy how to collect clods of earth with newly-hatched insects on them, and then examining them oneself. TRAMONI, a technical anti-phylloxera agent, has discovered a simple way of causing phylloxerae to leave any infested stock, when the soil is very dry. The stock is abundantly watered (8-10 pints water to half a square yard) and after about an hour, sometimes sooner, the ground shows fissures from which the first newly-hatched insects emerge.

To confirm the exit of phylloxerae, a sheet of white paper smeared with some sticky substance (vaseline oil does very well) may also be spread near the infested stock. The paper is left all day, or for some shorter period; it may be then removed and examined at leisure. By careful observation, preferably with a lens, some phylloxerae will be sure to be found adhering to the grease. Vessels full of water may be also employed, as the phylloxerae are apparently attracted by the water and fall in.

The exit of the phylloxera may be observed during the whole of the time the eggs are hatching on the roots. There is none in the spring because when the hibernating insects awake they do not leaves the place to which they are attached, neither going down to the young roots nor creeping up to the surface. Nor, again, does the phylloxera emerge during the summer in those places where, owing to a prolonged period of drought, the first larvae are in that state of development which has been compared to hibernation, and for that reason is called aestivation (FRANCESCHINI). But aestivation is not general on all the roots of a vine, and in this case, which might be termed semi-aestivation, the extent of the exit is considerably di-

minished though not entirely absent (see above for the means used by TRAMONI to stimulate it).

In northern Italy the exit has been observed from the end of May to the middle of September (on high ground) and even till the middle of November (on low ground). In Apulia during the most favourable years, it may extend from the beginning of May to the end of December, but where the growth is weaker and the soil parched, the occurrence is slacker from the second half of July to the end of August, for the precise reason of the above mentioned semi-aestivation. Late in the season when owing to the temperature being low, the soil does not dry up and crack, the exit may not take place, even if the hibernation be as yet only partial.

The fall of rain during the period of multiplication of the phylloxera will immensely increase the extent of the phenomenon (TOPI).

The emergence from the soil of phylloxera has now been observed throughout the whole of Italy. It takes place to a greater or less extent in almost any soil. In loose soil it is easily observed because of the many tiny fissures, so close together that the first larvae have no difficulty in crawling to the surface. In very loose soils, which do not crack, it does not occur.

It may take place at any hour of the day, but stops during the night. In southern Italy, during the warmer months, it diminishes in extent greatly and may even cease entirely from 10 a. m. to 3 p. m., while in the autumn months it reaches the maximum at about 2 p. m. In northern Italy that hour always marks the maximum.

The phenomenon of the emergence of first larvae is in harmony with theoretical considerations. The presence of eyes in hypogeal phylloxera, and especially the fact of their being nearly of the same size in the first larvae (newly-hatched insects) as in the mothers, which are much larger, might already have led us to suppose that first larvae were intended to move to the surface of the soil.

For an accurate appreciation of the exit of the young larvae it is necessary to know if, and to what extent, they can withstand the open air. It would seem that such delicate and tiny animals would speedily succumb, and yet we see them moving about in the hot sun for some time without suffering. Evidently the moisture given off from the soil is sufficient to enable them to live. It is a fact that during exceedingly hot days in July, even in Apulia, they were watched for about two hours, and were still moving about when the observation was interrupted. Undoubtedly many of the emerged larvae will die, but many will also wander to fissures in the soil through which they will find their way to roots of vines still immune and infect them. And it must be borne in mind that the number of emerging larvae is infinite. To give an idea of their number, it will suffice to say that on a greased sheet of paper, as previously described, 16 ins. × 8 ins., laid casually, after a shower of rain, near an infested stock, on the 13th July 1914, TOPI counted 51 larvae; and even in fine weather on a piece of ground 2 ½ sq. ins. in size, 30-40 may be seen without difficulty.

FAUCON had already observed that the wind could raise them to a height of about 6 feet and carry them some distance. This phenomenon,

denied by BALBIANI, has been confirmed in Apulia by TRAMONI, but not yet in Piedmont (TOPI).

It had been noticed in many cases that the spread of phylloxera infection followed the direction of the prevailing winds. This fact, which had been attributed to winged phylloxerae, must be ascribed instead to the first larvae.

It is well known how frequently small outbreaks occur in greater or less proximity to a centre of infection. This used to be explained by reference to the winged forms. BÖRNER, also, has recently referred to fresh cases of infection that only seem capable of explanation by means of sexual generations. When, instead of these suppositions in which the essential appearance of galls is lacking, we have recourse to the definitely certified migration on a large scale of first larvae, the cause both of the isolated outbreaks and of these unexpected new infections is obvious. From the observations recorded up to this point, the doubt might have arisen that the first radicola larvae were of two kinds, one intended to infect the vines under ground, and the other by creeping to the surface of the soil. This doubt has been removed by a series of experiments from which we have the clearest evidence that any particular first larva may or may not emerge, and that it is undoubtedly the light which attracts them and directs their course. We are of the firm opinion that all first larvae will come to the surface even under the influence of a dim light penetrating to them through the soil, provided they find a passage. But even those to which no light at all penetrates, are capable of fixing themselves and developing on the roots where they are born, or of infecting others in contact or even not in contact with them; in the latter case finding their way through fissures in the ground. It should be understood that we have also proved experimentally that the emerged larvae can find their way to the vine roots and actually infect them. A further demonstration has been given by TOPI: he has observed that layers, made by laying the vine canes just below the surface of the ground so as to increase the production or to obtain new rootlings are often infected before the actual vine to which they are attached.

We doubted for a short time that the emerging phylloxerae were all destined to become winged; this doubt has also been removed by experiment (1).

To sum up: the exodus of first larvae is a much more serious phenomenon than even FEANON himself had believed, and we may be certain that though many perish, the survivors are more than sufficient to ruin our vines.

The first larvae after their exit may, in certain cases, take to an epigeal life on the vine, and produce offspring capable of forming galls. This result had already been obtained by FRANCESCHINI, in particular, by laboratory methods. The phenomenon once occurred spontaneously on a larger scale in our hothouse in Tuscany. In this case the adventitious roots

(1) I will add, finally, that in observing the exit of first larvae one often finds nymphs; these we know to become winged on, or close to, the surface of the soil.

n which the emerged radicolae had established themselves must have served s the channel, in other words, from the adventitious roots the radicolae presumably passed to the green parts of the vine, which became covered vith galls. Very probably a similar thing may happen in nature during ainy seasons in damp and shady places.

It was interesting to know the morphological characters presented by hese gallicolae, which we have termed "direct" to distinguish them from hose derived from the winter egg, which may be called "indirect". It nay be said that as the generations become more numerous, direct gallicolae resemble more and more the indirect forms, but never become completely similar (FOÀ).

IV. — THE QUESTION AS TO THE EXISTENCE OF DIFFERENT RACES OF PHYLLOXERA.

We wish here to discuss the question raised in recent years by BÖRNER, who believes it possible to distinguish the phylloxera of Lorraine as a special biological race, (variety) which he denominates *pervastatrix*. As his publications on the subject have not been properly reviewed by viticultural papers, I consider it would be useful to summarise them here.

BÖRNER says in a preliminary note (1910) that in Lorraine the winged insect prefers European vines for its oviposition to the American vines usually found covered with galls in southern Europe; that only on European vines did he find the winter egg, and only on European vines and the Labrusca variety were any galls developed.

From these and similar observations, which brevity forbids me to quote, BÖRNER argued that as the phylloxera has lived in Lorraine for about forty years on European vines, it must have acquired biological characters, that s, tastes and habits etc., different from those of the original form. He therefore considered the specialization of the phylloxera of Lorraine into a race peculiar to the European vines and to Labrusca to be nearly completed. But o this we objected in 1912 that BOITEAU had very often found winter eggs n European vines at Villegouge (France) on which galls were very well eveloped as early as 1875; the race in question would therefore in any case ave been in existence since phylloxera was first introduced. Nor could BÖRNER'S experiments, being for the most part carried out in the hothouse nd with only a scanty number of stock larvae, be trusted to represent xactly a phenomenon as it occurs in nature. (FRANCESCHINI also obtained he laying of winter eggs on shoots of our own Italian vines placed in a pecial apparatus where winged and sexual insects were allowed a free hoice). Finally, attention must be drawn to the exceedingly variable ehaviour of American vines towards gallicolae, and also to the different ceptivity towards gallicolae of the various varieties of *vitis vinifera*. That he changes in the mutual relations between phylloxera and the plant, with spect to gall formation, are not to be attributed to the insect, and to he insect alone, but to a combination of circumstances, results from a

series of well established facts, e. g. 1) the existence in Sicily of plots of Rupestris du Lot covered with galls, close to other plots where the same vines only showed the tiny characteristic circles (see note on page 1274) in the spring; 2) other plants of "Rupestris du Lot" which in the spring showed a number of circles and few galls, and were later in the season perfectly covered with galls; 3) six contiguous plants of Aramon × Rupestris N. 9, two of which were immune from galls and remained so even after attempts had been made at artificial infection, whilst the other four had galls already in the spring — and so on.

Of recent years, BÖRNER has brought forward new arguments in favour of his theory, yet he does not deny the possibility of this new race *pervastatrix* being already in existence in America on the Labrusca variety and being thence introduced into Europe.

He grew in pots filled with the same kind of earth, a quantity of slips cut from the same mother plant, and at the proper season half of these were infected at Villers l'Orme with phylloxerae from Lorraine, the other half at Pagny sur Moselle (not far distant) with phylloxerae from the south of France. This experiment was carried out simultaneously on vines belonging to several varieties (1). The result, a remarkable one, was as follows: a regular formation of galls and nodosities at Pagny, and complete immunity at Villers l'Orme for the following varieties:

Riparia × Gloire de Montpellier
Riparia × Rupestris 107 Geisenheim
Riparia × Rupestris 3306 Couderc
Riparia × Rupestris 3309 Couderc
Cordifolia × Rupestris 19 Geisenheim
Riparia × Chasselas 25 Laq.

The attempts made by the author of the experiments to infect these vines with Lorraine phylloxera never succeeded, although the trials were made under various conditions of season, soil, and environment (hothouse or vineyard) etc.

These, and other similar experiments, are undoubtedly striking, and make us curious to ascertain what would be the behaviour of *pervastatrix* if transported to our country. We were just about to make this test (here as in previous researches with the support of the Ministry of Agriculture) when war was declared. We thus limited our studies to the behaviour of Italian phylloxera.

If it be really true that the Lorraine phylloxera forms a distinct variety, it is probably not the only one, and others may be found in different countries. We have reason to believe that a variety only slightly different from *pervastatrix* is to be found in the province of Novara; but any pronouncement on the subject would be premature.

On the other hand, the supposed existence of various biological races might perhaps be connected with a fact of great practical importance, the

(1) See *B.* August 1914, N. 799. (*Ed.*).

enormous difference, that is, between the results obtained in the fight against phylloxera. In some regions the contest appears to have been wonderfully successful, in others, instead, the existing conditions have been worsened.

As regards the first case I will give four instances of which I have made a particular study: the plain of Novara, the Abruzzi, Perugia and some parts of Tuscany.

As representing the Province of Novara we may take the Commune of Oleggio, and, more particularly, the history of "La Fenice", a vineyard belonging to Commendatore BALSARI, one of the few who understand the importance of the campaign against phylloxera, be it ever so costly.

"La Fenice" covers nearly twenty acres of ground and contains about 14 000 splendid vines. In 1896 two centres of infection were discovered, one of 63, the other of 98 vines; both were destroyed by the Government together with 640 healthy vines of the precautionary zone. In 1897, five small centres of infection were discovered, consisting respectively of 2, 3, 1, 5, 6, and 10 vines which were destroyed without any precautionary zone. Other small centres were found and destroyed in subsequent years (two respectively of 8 and 3 vines in 1898, one of 4 in 1905, one of 13 in 1908, one of 7 in 1909, and one of 4 in 1910). In 1911, a very careful examination was carried out for about two-thirds of the vineyard, under the supervision of my assistant Dr FOÀ, including the intermediate spaces of ground between the vines. This was considered necessary in that locality, owing to the great development of the single vines. By this method, a vine was discovered to be infected which had appeared to be immune when merely examined near the stock, according to previous custom. The scrupulous examination of 1911 showed 67 infected vines, but 58 of these belonged to a plantation of slips from European vines which, it should be noted, had been imprudently planted the same spring in the place of vines which had been destroyed the previous year. In these places were actually found roots of the old vines on which a few phylloxerae were still alive. In 1912, another exceedingly careful tour of the whole vineyard was made, and a new centre of 6 vines discovered, while another 23 vines more or less distant from the old centres were also found to be infected; a very small number in comparison with the 14,000 plants in the vineyard. In short, "La Fenice", planted with European vines, is a vineyard in the very best condition, in spite of phylloxera having made its appearance in it about twenty years ago.

More surprising still is the state of another small vineyard in the Commune of Oleggio. This was also found infested in 1896; nearly one half was destroyed and subsequently replanted with European vines. No further inspection was made until 1911 when each vine was examined separately, not one of them showing the least trace of infection. It is remarkable that not far from the vineyards mentioned, are others badly infected and others, again, which were entirely killed by phylloxera several years ago.

The examples in the Abruzzi are not less interesting.

In 1906, in one property 1184 vines were found to be infected; these were destroyed together with 2616 healthy vines in an infected zone and 1690 in

the precautionary zone; in subsequent years no trace of phylloxera was ever found. In another property, 163 infected vines were destroyed in 1909, together with 456 healthy ones in the infected zone, and 922 healthy vines in the precautionary zone; in 1911, 5 infected vines were discovered and destroyed with 198 healthy ones in the precautionary zone, following which the infection ceased completely. These cases occurred at Città Sant'Angelo, and others could be mentioned were it not superfluous. It may be added, however, that these cases have been fully confirmed by the results of the careful tours of inspection around the centres mentioned during the last two years.

To sum up, in various Communes of the Province of Teramo (Abruzzi) phylloxera spreads exceedingly slowly, while in other localities the spread is very rapid. As an example we may take the case of the Pavoncelli vineyard at Bonassise (near Cerignola in Apulia) where the inspections were carried out no less carefully than in the Abruzzi. In this vineyard the number of infected vines in 1912 was 174. Notwithstanding the prompt destruction of these, of the healthy vines in the infected centres, and of those in the precautionary zone, 1228 vines were found to be infected in 1913, and in the last season over 3397.

Taking the province of Teramo as a whole (with the exception of the Commune of Montesilvano) one gathers that from 1901 to 1914, the centres of infection destroyed amount to 302 (an average area of 116 acres) of which 79 (76 acres in area) in the first three years, and 223 (only 39 acres in area) in the ten following years. There has evidently been a check in the spread of phylloxera, such as did not occur even in the Canton de Vaud where the work of defence, I an told, is admirably conducted and excellent results obtained. During the three years from 1886 to 1888, the stocks found to be infected in Canton de Vaud numbered 128 and in the following years respectively 8 — 89 — 134 — 14 — 144 — 3800 — 2028 — 11958 (in 1896), and so on with ever increasing figures of which we may quote 30 951 (in 1899), 134 086 (in 1905) 169 478 (in 1908) 129 393 (in 1912).

There are other localities in Italy, such as Perugia, Brolio, Cortona, and Marcena near Arezzo where phylloxera behaves in the same way as in the Abruzzi.

Phylloxera was recorded at Perugia in 1891 (introduced by rootlings furnished by a Florence horticulturist). In 1891, the number of centres discovered amounted in all to 37, with 10 120 infected vines (1518 at Perugia and environs, 473 in the district of San Martino in Campo, 8129 in the districts of Ginestrella and Ripa); the infection was widely distributed. In 1892, only 230 infected stocks were discovered, 67 in 1893; 15 in 1894; and 42 in 1895, in which year 328 more were found in the neighbouring Commune of Val Fabbrica; 22 in 1896, when 3 more were found in the adjacent Commune of Gubbio; 56 in 1897; 7 in 1898; 9 in 1899; 2 in 1900; 4 in 1901; 5 in 1902; 10 in 1903; 1 in 1906; 7 in 1907. All these vines were destroyed as soon as they were found to be infected (likewise the 7 of 1907?). After 1907 no further inspections were made until the summary investigations I had carried out by experts during the present year, when only negative results were ob-

tained. A few infested vines may have escaped observation, but they would only be very limited cases of infection. It must be admitted that such results are truly surprising, in fact almost incredible when one thinks of what has occurred in other parts of Italy, in Switzerland, etc.

Similar accounts may be given of the infections at Cortona, Marcena and Brollo, where in spite of the exhaustive search made during these latter months, not a single vine attacked by phylloxera was discovered.

How can these facts be explained? It has been noticed that the worst ravages occurred in the regions where vineyards were specialized; and the least in those where the vines are kept high, planted in rows with intervening plots cultivated with herbaceous crops, or where the vines are trained on trees and at a good distances apart etc. (1). It has also been proved that the damage makes less rapid progress among vines whose epigeal, and consequently also the hypogeal portions, are well developed. As the development is strictly connected with the quality of the soil, this fact was also taken into account. Other factors have been considered, such as the division of the property and the share system which exclude, more or less completely, extraneous factors capable of spreading phylloxera (2).

Undoubtedly, all these circumstances have their value, and the intensity and accurary of method with which the battle against phylloxera has been conducted, also count for something, but they still appear insufficient to give a complete explanation of all the phenomena under discussion.

I am convinced that something still escapes us, and that this something is contained in the following dilemma: either the phylloxera becomes weakened or in certain localities becomes benignant in response to its environment, or there are benignant (3) and malignant races of phylloxera. It would seem natural to suggest infectious diseases capable of destroying phylloxera, but this possibility would seem to have been excluded by the researches already made.

The point of which the foregoing paragraph treats seems to us the only really important one in the biology of phylloxera that still requires elucidation. Experiments have already been begun with this object. Let us hope they will be decisive.

(1) We may here mention the celebrated viticulturist Oberlin, who, returning to antiquated and discredited ideas, asserts that by allowing the European vine sufficient vegetative expansion, with a suitable system of pruning (horizontal cordon 16 ft. long with double spur) it can be rendered immune to phylloxera, wihout any necessity for inoculation or curative treatment! I take these notes from a report by Dalmasso.

(2) It is not believed that the variety of vines cultivated exercises any special influence, but this point deserves further consideration, for, as PAULSEN has recently ascertained, the Trappato variety succumbs much later then other European vines. (In any soil?)

(3) DANIEL (1908) firmly believed that of late years in some parts of France, the destructive power of phylloxera had diminished and that in general the presence of American vines infused new life into the already extenuated generation of phylloxera on the European vines. He suggested that entomologists should examine his hypothesis; we have therefore studied the question very carefully, but have been obliged to conclude that there is not the smallest sign in its favour.

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SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

97 - **Agricultural Production in the Republic of Honduras.** — I. The Economic Situation in Honduras ; Agriculture and the Fruit Trust, in *Revista Económica*, Vol. IV, No. 9, pp. 521-525. Tegucigalpa (Honduras), January 1915. — II. Honduras, Imports of Merchandise 1913, (Year ending July 31), *Ibidem*, pp. 537-540.

Bananas 1epresent 50 per cent of the exports of Honduras ; coffee, ttle, coconuts, hides and timber together make up 22 per cent.

The cultivation of the banana is confined to the coastal regions of the lantic slope, either for reasons of transport and market, or because of the h soil, the damp, warm climate and the absence of high winds. In dis- cts where intensive cultivation of bananas is practised, this crop covers out 70,000 acres, of which more than half is in the hands of trusts. Coffee grown chiefly in the southern departments, and in spite of the favourable nditions of the soil its cultivation has hitherto been much limited owing difficulties of transport and shortage of labour. The produce consumed in country is of local origin : beans, maize, potatoes, green vegetables and at ; their production is, however, also unremunerative, on account of ficulties of transport and want of capital.

A summary of the agricultural exports of Honduras is given in the fol- ving table, the financial years ending in each case on July 31 of the year en.

Products	Units	1912	1913
Bananas	bunches	5 897 979	6 246 182
Coco nuts	nuts	10 059 519	9 722 953
Cattle	head	15 656	19 017
Hides	lbs.	820 457	948 860
Coffee	lbs.	688 212	493 563
Rubber	lbs.	107 738	62 077
Tobacco	lbs.	119 748	83 523
Sarsaparilla	lbs.	129 437	125 078
Mules	head	210	91
Timber (cedar, mohagany)	$	11 532	16 048

Average Prices Compared.

Products	1912	1913
Hulled Coffee	$ 11.90 per 46 kg	$ 11.84 per 46 kg
Bananas	$ 0.235 per bunch	$ 0.255 per bunch
Hides	$ 0.13 per lb	$ 0.15 per lb
Coco nuts	$ 19.37 per 1 000 nuts	$ 18.57 per 1 000 nuts
Rubber	$ 0.58 per lb	$ 0.54 per lb
Mahogany	—	$ 36.20 per 1000 feet

RURAL HYGIENE

998 – **The Destruction by Crude Sulphuric Acid of the Pathogenic Bacteria Present in the Waste Water from the Premises of Horse Slaughterers.** — FOTH, H. and SCHUBERT, B., in *Deutsche Tierärztliche Wochenschrift*, Year 23, No. 35, pp. 287-289. Hanover, August 28, 1915.

In public establishments for dealing with animal carcasses in Germany, the waste water must be disinfected before allowing it to flow into a stream, or on to a filter bed. As a disinfectant, crude sulphuric acid has been recommended in Germany, where in normal times, it is sold at 3s 9d - 5s 9d per 100 lbs. The writers have experimented to ascertain whether this acid is sufficiently efficacious in destroying pathogenic germs in waste water. As specimens of disease-producing bacteria those of splenic and of symptomatic anthrax, were used *i. e.* species with very resistant spores. The bacteria were first injected into guinea-pigs and mice, the animals being afterwards killed and their bodies subjected to the disinfectant action of the acid. After disinfection it was determined whether all the bacteria had been destroyed. The writer concluded that sulphuric acid mixed with water in the proportion 3 : 1000 causes the complete destruction of the above-mentioned bacteria provided the mixture remains unchanged for 24 hours.

999 - **Agricultural Instruction in Russia.** — *Semledielez* (*L'Agriculteur*), Year XX, No. 4, pp. 190-191. Petrograd, 1915. AGRICULTURAL EDUCATION

Whereas in 1895 there were in Russia only 82 agricultural schools of ll kinds, in 1913 their number amounted to 360. The total number of upils was respectively: 4130 and 17 960 (in 1912). The number of schools nd pupils has therefore increased about 4 ½ times. It is interesting to otice that this increase holds good for each kind of school. The number f higher schools has risen from 2 to 10; that of the medium grade schools rom 9 to 18 and that of the lower grade from 71 to 332. An interesting letail is here noticeable regarding agricultural schools for girls. These were, n the last century, very few in number and all of an inferior character, whereas in 1912 there were already 24, these being divided as follows: 2 igher schools with a thousand pupils, and 11 mixed schools, of which 3 elonged to a superior type. More rapid still is the evolution of agricultural nstruction amongst the adult rural population, both as regards the short courses and lectures. In 1905, agricultural courses were only held in 18 pla-es and the number of students was about 2000, while in 1912, 868 places oasted of such courses and the students rose to 58 000. About 75 per cent f these courses lasted for a fortnight. The courses intended for the adult ural population are of the most varied character; sometimes dealing with a ingle branch of agriculture, sometimes with the subject as a whole, thus esembling the type of instruction given in the lower grade schools. Tra-elling agricultural courses, organised in special railway carriages and on the iver boats are of particular interest. Courses of this kind are held on the rans-Siberian railways transporting emigrants to Siberia, on the Vladicau-as and the Moscow-Khasan lines and on the steamers plying on the Volga, bi etc. As regards agricultural lectures, whereas, in 1905, these were only eld at 85 places, and were attended by 32 000 listeners, in 1912 they were iven at 11 162 places and the audience exceeded a million. The subjects f these lectures are very varied, dealing with the different problems of agri-ulture, stock-breeding, cooperation etc. A great part of this work of spread-g agricultural knowledge among the rural population devolves upon the emstvos and the agricultural associations. In fact, almost two-thirds of e total number of agricultural lectures have been organised by the zemst-s, and three-quarters of the lecturers have been agriculturists from the mstvos and the agricultural associations. In the same way, 45 per cent f the agricultural courses mentioned above were instituted by the zemstvos nd 38 per cent by the different agricultural associations.

000 - **Agricultural Research in Russia.** — *Département de l'Agriculture, L'Industrie agricole en Russie* (text in Russian and French), pp. 157-184, maps, diagrams and photographs. Petrograd, 1914. ORGANISATION OF EXPERIMENTAL AND ANALYTICAL WORK

From the publications of the Department of Agriculture (*Recueil de nseignements sur les établissements expérimentaux agronomiques en Russie*) nquiries of 1910 and 1912), and 2; *Liste des établissements expérimentaux ronomiques jusqu'au 1 janvier* 1913. *Budgets des revenus, des dépenses et s ressources spéciales du Département de l'Agriculture, en* 1895, 1901, 1907 1912, as well as from the papers relative to the expenditure by the De-

partment itself, the following data were obtained regarding the number, type, ownership and situation of the experiment stations of Russia, together with their development, increase of annual expenditure and the capital required for their organisation.

The distribution of the experiment stations in each province is as follows :

Provinces	Number of provinces in each category			
	in 1895.	in 1901.	in 1907.	in 1912.
Without Experiment Stations	67	52	42	17
With 1 Experiment Station .	17	23	23	28
» 2 » »	6	7	14	12
» 3 » »	1	6	5	16
» 4 » »	1	2	3	4
» 5 Experiment Stations and over	0	2	5	15

In the following table the different provinces are arranged according to the grants by the Ministry of Agriculture for their experiment stations:

Provinces	Number of provinces in each category.			
	in 1895.	in 1901.	in 1907.	in 1912.
No expenses	72	57	47	19
Expenses amounting to:				
Below £ 520	8	16	23	12
From £ 520 to £ 1 600 .	9	15	15	17
From £ 1 600 to £ 2 680 .	2	1	5	8
From £ 2 680 to £ 3 720 .	0	0	1	12
£ 3720 and over.	1	3	1	24

The increase in the number of experiment stations in general and also under the different controlling bodies may be tabulated as follows :

Years.	Numbers of Experiment Stations under the different controlling bodies.				
	Belonging to the crown.	Belonging to the zemstvos	Belonging to agric. societies	Belonging to other Institutions and to private persons.	Total Number of Experiment Stations.
895	14	3	6	4	27
901	25	11	18	9	63
907	39	15	27	11	92
912	62	70	65	15	212

Amongst the different categories of experimental stations there are ncluded the "special" Selection Stations (of Karkow, Moscow and Li-onia, in 1912), the Stations for the testing of machinery (of Livonia, the Territory of the Don Cossacks and of the Government of Tobolsk) the Vi-icultural Stations (of Kerson and Bessarabia), the Horticultural Stations of the Taurus, the Governments of the Black Sea, Warsaw and of the dis-rict of Soukhoum), the Stations dealing with the marshes (of Minsk and Livonia), the Phytopathological Stations (of the Governments of Petrograd nd Warsaw), the Stock-Breeding Stations (Government of Warsaw), nd, finally, the Fish-Hatchery Stations (Government of Radom). Among he "laboratories" are included 8 laboratories for milk analysis, 4 for soil nalysis, 3 for agricultural bacteriology, 1 agricultural, 1 for agricultural hemistry, 2 for ichthyology, 1 stock-breeding, 1 phytopathological and 1 xperimental laboratory for tobacco-growing. The name of "Control tation" is given to all establishments engaged in the control of seeds, oils, fertilisers, forage and food products. "Experiment Fields" include Special Fields" for the experimental growing of tobacco and cotton, the ultivation of marshes etc.

The gradual increase in the number of the different kinds of Experi-ient Stations is shown as follows :

Distribution of Experiment Stations.

Years.	Experiment Fields.	Experiment Stations.	Laboratories.	Control Stations.	Totals.
895	13	10	2	2	27
901	34	20	6	3	63
907	43	27	16	6	92
912	113	59	22	18	212

The relative part played by the Crown, the Zemstvos, Agricultural ocieties and by other institutions and individuals in the founding of diffe-nt types of experiment stations during the same period of 18 years is hown by the following figures :

Years	Number of Experiment Fields				Number of Experiment Stations				Number of Laboratories				Number of Control Stations			
	Belonging to the Crown	Belonging to the Zemstvos	Belonging to Agricultural Societ.	Belonging to other Institutions and to Individuals	Belonging to the Crown	Belonging to the Zemstvos	Belonging to Agricultural Societ.	Belonging to other Institutions and to Individuals	Belonging to the Crown	Belonging to the Zemstvos	Belonging to Agricultural Societ.	Belonging to other Institutions and to Individuals	Belonging to the Crown	Belonging to the Zemstvos	Belonging to Agricultural Societ.	Belonging to other Institutions and to Individuals
1895	6	2	4	1	6	1	—	3	1	—	1	—	1	—	1	—
1901	11	9	11	3	10	2	2	6	3	—	3	—	1	—	2	—
1907	13	10	15	5	13	3	5	6	12	1	3	—	1	1	4	—
1912	30	47	30	6	16	15	20	8	15	1	5	1	1	7	10	—

The following data, which bring out best the condition of the agricultural experiment stations and the changes that have taken place in these conditions during the 18 years under consideration, are based on the material collected by a special enquiry conducted by the Intelligence and Publications Bureau of the Department of Agriculture at the end of 1913, into the whole of the agricultural experiment establishments in Russia with the object of obtaining data, which though general in character, might be capable of being elaborated and arranged according to a common plan. From 205 purely agricultural experiment stations (according to the list of January 1, 1913), the Bureau received replies from 161, or about 79 per cent of the total number. The stations sending answers are divided according to their type in the following manner:

	Total No. of Stations on Jan. 1. 1913.	No. of Experiment Stations of Each Kind.	
		Which replied to the enquiry and are registered.	No reply.
General Agricultural Experiment Stations .	36	32	4
Special do	20	18	2
General Agricultural Experiment Fields . .	94	68	26
Special do	12	11	1
Agricultural Laboratories	18	13	5
Control Stations	17	12	5
Experimental nurseries	4	3	1
Experimental Farms	2	2	—
Centres for practical experimental work in different parts of the country	2	2	—
General total of establishments . . .	205	161	44

Further, it is necessary to note that some of these Experiment Stations ave not replied to all the questions of the enquiry, while others though ney answered all the questions, yet their replies did not embrace the whole eriod under consideration. In these circumstances the data given are ot of importance as absolute figures but should be taken rather as relative verages.

The increase in the total numbers of the scientific staff of the Stations given in the following Table:

Years	No. of Stations existing in each year and which replied to the enquiry	Staff of the Establishments			
		Total Number of individuals employed	Class of education received by the members of the Staff and the number in each		
			Higher	Medium	Lower
895	15	46	18	13	12
901	35	103	49	35	19
907	62	210	101	65	44
912	153	565	325	125	115

The average numbers on the scientific staffs of the experimental sta- ons towards the end of 1912 is shown by the following Tables :

A. *Stations of Different Types.*

	Average Numbers of the Scientific Staff per Station	Average Number of individuals who have received higher education
	—	—
Special Experiment Stations	6.0	4.0
General Agricultural Experiment Stations.	5.4	3.2
Control Stations	4.6	1.7
Laboratories	2.7	2.0
Nurseries.	2.7	1.3
General Experiment Fields.	2.6	1.4
Experimental Farms	2.0	0.5
Special Experiment Fields	1.7	0.9

B. *Stations of Different Provinces.*

Experiment Stations of the Province	Average Numbers of the Scientific Staff per Station	Average Number of persons who have received higher education
—	—	—
Belonging to the Zemstvos	3.0	1.7
» » Crown	3.7	2.1
» » Agricultural Societies . .	3.9	2.5
» » individuals	4.0	2.5
» » other Institutions . . .	7.7	2.7

The following absolute figures as to the expenditure of the Department of Agriculture for experimental purposes are based upon those for the year 1895 and for the period 1901-13:

Expenditure of the Department of Agriculture.

Years	For maintenance and organisation of the Crown Experiment Stations	For grants to the Experiment Control and Meteorological Stations	For general experiments and research not carried out in the Stations	Salaries of Research Specialists	For the organisation of meetings and the travelling expenses of the staff	Salaries of practical experts	Cost of publication of the results of the experiments	Total sum expended for experimental purposes	Expressed as percentages of the total expenditure of the Department of Agric
	£	£	£	£	£	£	£	£	%
1895	16 186	3 912	—	—	—	—	—	20 099	5
1901	24 148	7 559	—	—	—	—	317	32 025	10
1907	26 400	11 704	2 167	—	127	—	423	37 650	10
1912	79 201	117 729	34 975	4 895	2 548	7 401	2 114	248 865	11
1913	229 147	206 172	48 107	7 083	7 083	8 194	2 748	504 656	16

Finally, the following absolute figures obtained from the financial statement give an idea of the gradual increase, during the period 1895-1912, of the expenditure of the Agricultural Administration for the support and organisation of the different kinds of Experiment Stations.

Type of Station		Expenditure of Department of Agriculture			
		In 1895	In 1901	In 1907	In 1912
		£	£	£	£
Agricultural Experiment Station	(*a*) Maintenance and organisation of Crown Stations	8 818	12 507	13 670	41 752
	(*b*) Grants to Station belonging to Social Organisations and individuals	624	1 110	1 977	48 815
Agricultural Experiment Fields	(*a*)	2 453	7 094	4 842	57 781
	(*b*)	1 734	2 907	5 022	51 691
Laboratories	(*a*)	1 374	3 098	5 318	13 438
	(*b*)	—	444	793	4 261
Control Stations	(*a*)	—	63	137	275
	(*b*)	31	105	338	6 788

CROPS AND CULTIVATION.

001 – **The Aeration of Cultivated Soil** (*Method and Results of Experiments made in Russia*). — DJARENKO, A. G., in *Iswiestiia Moskowskago Selskochosiaistwennago Instituta* (*Annals of the Moscow Agricultural Station*), Year XXI, Vol. I, pp. 1-41, Moscow, 1915.

Of the principal factors concerned in plant life (light, heat, air and nutritive substances) only the two last have been studied in such a manner as to allow of the devising of various technical methods for ensuring to plants the necessary amount of water and nutritive substances. As regards light, heat, and air, these are factors outside our sphere of influence and can be but little modified by cultural technique. In the case of the air however, this assertion only holds good for the aerial parts of the plant, since for the normal development of its root system and the chemical and biological processes continually going on in the soil, oxygen is indispensable. It is thus evident that the conditions guaranteeing the presence of sufficient air for the plants can only be obtained by the help of an active exchange between the gases contained in the soil and the air.

These circumstances necessitate our studying the conditions which assure to plants the presence of sufficient oxygen in the soil, and to the technical means for preserving an active gaseous exchange in the soil. But, since research on the composition of the air in the soil has hitherto furnished data relating almost exclusively to its content of carbonic acid and of some other gases, and since, further, there is no connection between the amount of carbonic acid and that of the oxygen in the air of the soil, the method of indirectly determining the oxygen cannot be applied. Experiments have therefore been based on the direct estimation of the oxygen in a given volume of air corresponding to a determined volume of soil.

A special apparatus has been made for taking soil samples, and the whole apparatus for the study of soil aeration consists of a mercury pump, some small graduated tubes and a series of absorbents of the various gases.

In summarising the most important results of the experiments carried out by the writer, especial consideration will be given to those relating to the different types of fallow land, as the question of the most appropriate type is of paramount importance to Russia.

As a matter of fact the Agricultural Stations have been able to establish, after a considerable amount of research, that the so-called black fallow and the April fallow ensure the best crop of winter cereals. Further, the experiments made by the Agricultural Stations of South Russia have shown that there exists a definite connection between the manner of working the fallow and the humidity of the soil; while a series of recent experiments clearly show the importance of the date of beginning to work the fallow in connection with the accumulation of nutritive substances (1).

Equally important is the working of the fallow land in order to insure

(1) See *B.* June 1915, No. 576. (Ed.).

the most efficient aeration of the soil, and in connection with the related physical, chemical and biological processes.

The experiments were carried out on 4 types of fallow viz., the so-called black fallow (the working of which begins in autumn), the April fallow and the two June fallows of which one, the "peasant" fallow, is characterised by having a soil much trodden by the cattle that the peasants usually put to graze upon it; the other is left unworked until June.

The results of the experiments are given in the adjoining table.

In analysing this table it is seen that the black fallow soils and the April fallow soils always contained larger quantities of air and oxygen in comparison with the other types of soil studied, this was especially the case during the first experimental period which lasts from the beginning of working the soil until the time of sowing. As regards the modifications in the amount of oxygen in the soil of the different kinds of fallow, it appears that they are least in the case of the black fallows and April fallows and greatest in the June and peasant fallows.

Further, it may be stated that the aeration of the soil becomes less and less in proportion as the soil becomes more compact and that every fresh working of the fallow makes the soil looser and increases aeration, giving a new impetus to the gaseous exchange between the soil and the atmosphere.

In continuing the analysis, it is also noticeable that the consolidation of the soil takes place more suddenly in the best-worked fallows, but nevertheless their air and oxygen content is always higher, especially in comparison with the peasant fallows. The amount of oxygen in 1 litre of soil varies in the following manner:

Black fallow	59 — 81.5	c. c.
April "	63 — 81.4	c. c.
June "	52 — 65.2	c. c.
Peasant "	32 — 48.0	c. c.

In order to show better the difference between these various kinds of fallows, the data are given relating to the amount of oxygen found on August 1 *i. e.*, at the time of sowing. Taking the oxygen content of 1 litre of black fallow soil as 100, that for the corresponding amount of April fallow soil is 107, in the case of the June fallow 86.5 and in that of the peasant fallow 54.2.

Thus by working the fallow well, it is possible to ensure to the plant towards the time of sowing, and throughout the autumn, a sufficient quantity of air. The June fallow differs from the black and the April fallows during the first half of the summer; it approaches them in autumn, outstripping the peasant fallow, which is characterised by a low oxygen content during the whole of the summer.

After having established these differences in the oxygen content of different kinds of fallow, the writer, wishing to ascertain the influence of the winter season, made the necessary experiments on soil under rye, obtaining the following results (the soil samples were taken on April 24):

Results of Experiments.

Dates of taking soil samples and of the work done	Black fallow			Index (black fallow = 100)	April fallow			Index (black fallow = 100)	June fallow			Index (black fallow = 100)	Peasant fallow			Index (black fallow = 100)
	Air	Oxygen	Oxygen per cent of air		Air	Oxygen	Oxygen per cent of air		Air	Oxygen	Oxygen per cent of air		Air	Oxygen	Oxygen per cent of air	
	cc. in 1 litre of soil				*cc. in 1 litre of soil*				*cc. in 1 litre of soil*				*cc. in 1 litre of soil*			
April 20	325	65	20	100	325	46	19.6	70.7	220	43.8	19.9	66.5	150	28.7	19.1	43.1
April 27	305	58	—	—	240	48	—	—	—	—	—	—	—	—	—	—
Commencement of working the April fallow and of superficial work on the black fallow.																
May 1	360	70	19.5	100	420	84	20.0	122	220	42.6	19.3	60.7	158	28.6	18.1	40.8
May 12	290	52	17.9	—	—	—	—	—	—	—	—	—	—	—	—	—
Superficial working of black fallow.																
May 15	340	68	20.0	100	360	71	19.7	128	200	38.2	19.1	73.0	154	22.3	14.5	42.8
June 1	300	55	17.1	100	320	62.5	19.2	111	200	37.8	18.9	68.7	156	18.2	11.7	33.1
June 14	290	50	17.2	100	310	60	19.3	120	200	36.5	18.2	73.0	150	16.0	10.6	32.0
Commencement of working the peasant, black and April fallows.																
June 15	410	81.5	20	100	400	79.5	19.9	98.7	320	64.0	20.0	79.0	280	42.0	15.0	51.8
June 28	350	67	19.1	100	370	74	20.0	104.7	300	59.5	19.8	103.7	240	38.0	15.0	78.6
July 1	380	75	19.7	100	410	81.4	19.8	100.5	330	65.9	19.9	101.0	274	48.0	17.5	88.8
July 15	325	60	18.5	100	340	73	21.5	116.2	315	62.8	19.9	107.6	250	46.0	18.4	99.4
Sowing.																
August 1	340	70.5	20.7	100	360	71	19.8	95.6	300	58.3	19.4	93.7	240	41.0	17.0	82.1
August 15	320	63	19.7	100	350	69.5	19.9	100.0	290	57.6	19.6	99.5	220	32.0	14.5	73.6
September 1	310	59	19	100	320	63	19.4	102.1	270	52.0	19.3	101.6	220	32.0	14.4	76.3

	C.C. in 1 litre of soil Air	Oxygen	Oxygen per cent of air
Black fallow under rye	238	45.9	19.3
April " " "	232	45.4	19.6
June " " "	224	43.5	19.0
Peasant " " "	118	24.0	20.3

As is seen, the oxygen content drops to the level characterising the fallow soils on which work has not yet been begun. The supplies of oxygen obtained by working the fallow can thus only be used by the plant during the autumn, since towards spring they become very small. Further, the differences observed at first between the 3 types of fallow disappeared almost entirely towards the spring, the peasant fallow alone, as before, having the lowest oxygen content.

The above-mentioned results of the study of the aeration of fallow soils do not yet afford sufficient data to solve the problem of aeration considered as a factor of the greater productivity of black fallow and April fallow soils, but they allow us to conclude that the differences in the reserves and in the composition of the air in the soil recorded during the experiments, determine differences in the progress of the biological processes in the soil, which, working as a whole, give rise to the most favourable conditions for winter cereals. Considered from this point of view, the study of the aeration of the soils of fallow land is as important as that of the movement of water in the soil.

The writer also made experiments on soils under summer cereals and on a number of factors influencing the composition of the air contained in the soil. Amongst these he studied: *a*) the temperature; *b*) the diffusion of gases in the soil; *c*) the percolation of water into the soil; *d*) the removal by wind of the air in the soil; *e*) the formation of certain gases in the soil (carbonic acid and other gases).

The outstanding fact is that of all the factors concerned in gaseous exchange, the percolation of water is the most active, but it only occurs during periods of rain. Thus, rapid changes in the composition of the air contained in the soil are only possible when it rains.

At the close of his article the writer gives full details of the method for determining the aeration, porosity and absorptive capacity of the soil.

1002 – **Studies on Drought at the Experiment Station at Odessa, Russia.** — *Département d'Agriculture, Industrie agricole en Russie*, 196 pp. (Photographs and diagrams). Petrograd, 1914.

One of the most important subjects of the work of the Odessa Experiment Station is the thorough study of drought and of the measures taken against it. In the study of the root system of cultivated plants, very interesting results have been obtained, especially as regards the method used for producing a full complement of roots. In the experimental field more than 40 000 determinations of soil humidity have been made, with a view to studying the circulation of water in the soil under different cultural conditions. The nature of drought, its causes, and the methods for dealing with it would seem to be as follows :

I. *Nature and causes of drought.* — 1) The depths attained by the root systems are from 27 ½ to 28 ½ inches in the case of potatoes, flax and some other plants, from 3 ft. 3 in. to 3 ft. 10 in. for most Gramineae, 4 ft. 10 ½ in. for sunflowers and mangels, and more for lucerne and other perennials.

2) In order to ensure an abundant crop, the layer of soil containing the roots must be moist throughout its depth.

3) The chief causes of the phenomenon of drought are: *a*) the fact that towards the date of the spring sowings only a portion of the root-containing layer (at a depth of 1 ft. 3 in. to 1 ft. 7 ½ in.) contains moisture — this is the general rule when a succession of grain crops is cultivated and with summer wheats with a fallow every third year. This lack of humidity in the soil is due to the fact that with cereals usually all the available water of the soil is already consumed towards the end of the growing period; this consumption is completed by the weeds which appear after the harvest, with the result that the depth of the moist layer in the spring depends exclusively upon the autumn, winter and spring rainfall, which is often quite insufficient; *b*) the chronic lack of moisture over many years of the intermediate dry stratum of the soil lying beneath the upper and periodically wetted layer, and, as a result of this drying, the absence in that stratum of chemical processes transforming the insoluble mineral substances; *c*) the great depth at which the lower, constantly wet stratum is situated, which results in the intermediate dry layer of the soil becoming especially thick.

II. *Measures for combating drought.* — 1) The working (scarifying) of the stubble-covered surface as soon as the wheat is got in, with a view to the greater accumulation and saving of the humidity derived by the soil from the late rains.

2) The extermination of weeds;

3) The forming of the black fallow, by means of which the intermediate dry layer of soil is moistened and disappears, or rather gives rise to a continuous damp stratum.

4) A regular system of rotation founded, not only on the alternation of the crops themselves but also of the root systems (greater or less depth developed etc). This prevents the continued drying of the stratum containing the roots; some plants requiring the use of a cultivator, such as potatoes, maize, pumpkins, etc, do not use all the water available in the stratum occupied by the roots and therefore accumulate moisture for the following year.

3 – **Absorptive Capacity of the Soils of Mauritius.** — De Sornay, P., in *Department of Agriculture, Scientific Series, Bulletin* No. 1. (English Edition), 19 pp. Mauritius, 1915.

In the Island of Mauritius, at the time of manuring the sugar canes and other crops, there occur excessively heavy cyclonic rains.

The writer has carried out experiments for the purpose of determining if the absorptive capacity of the soil is such as to prevent appreciable loss of fertilising matter. The method principally employed, so as to make the conditions as similar as possible to those obtaining in practice, consisted in filtering a layer of 8 in. of different soils, the upper part of which had been treated with a known quantity of the fertiliser and in analysing the water obtained.

It was decided that the soils of Mauritius have a special power of absorb ing ammonia and potassium administered in the form of sulphate, these base can therefore only be removed by intensely heavy rain. Naturally, ther are variations, especially in the case of the less absorbent sandy soils ; th absorption of the potassium and ammonia seems to depend upon the amoun of clay and humus present, and in the case of potassium, upon the formatio of double hydrated silicates. In that of nitrates, especially of sodium ni trate, if rain falls immediately after its application, a relatively large propor tion of the nitrate may be washed into the lower strata, it may however b recovered by the processes of capillarity. The absorptive capacity is con siderable in the case of phosphoric acid in the form of superphosphates, o account of the formation of insoluble compounds, especially of lime, iron an alumina. In view of the fact that the soils of Mauritius contain large quanti ties of iron and alumina (30-40 per cent), and that phosphate of iron i practically insoluble, the use of superphosphates does not seem to b suited to that country.

1004 – **Fresh Researches on the Absorption of Ammonia by the Soil.** — PINNER, LUD WIG, in *Kühn-Archiv*, Vol. 6, Part 1, pp. 153-238. Berlin, 1915.

After a critical discussion of the different theories regarding the absorp tion of gases and liquids, the writer gives an account of his own experiment for the purpose of determining the absorptive capacity of different soils Research hitherto has dealt exclusively with the various constituents of th soil and the results are of no general value to practical agriculture.

As a substance capable of absorption the writer used ammonia ga which has the treble advantage of being easily absorbed, of existing in th air, and of constituting a source of nitrogen for the soil. The absorptio of the gas was determined by two different methods, various samples of soi being taken, some from Germany, some from other countries. The capacit of the soil for retaining hygroscopic moisture was estimated by the metho of MITSCHERLICH.

The experiments have shown that the absorption values do not allo of any better conclusions being drawn, for practical agriculture, than thos obtained from physical and chemical analyses of the soil. In German soil the absorption value was parallel to the hygroscopic value. In the case o " red soil " (1) (*terra rossa*) the hygroscopic capacity was more regular tha in German soils. This is probably due to the fact that the hygroscopi capacity of the *terra rossa* is not always comparable with that of the Germa soils.

The isotherms constructed on the values of absorption of ammonia ga by the soil closely resemble those constructed on the absorption values of th same gas by charcoal. The greater part of the gas was absorbed in a fe minutes, but a stationary condition was only reached at the end of son hours. In the case of soil still containing hygroscopic water, the absorptio value was much higher than in that of dry soil, but did not reach the sum

(1) The " Roterde ", or *terra rossa*, came in some cases from Istria, in others from Bra East Africa, etc. (*Ed.*).

ıe absorption values for dry soil and water. Part of the ammonia gas ab-
ɔrbed was strongly retained by the soil, even if the latter were subsequently
xposed for several weeks to the open air. It was impossible to obtain
ny parallelism between the absorption of an ammoniacal solution and that
f ammonia gas, although, according to the writer, some relation does exist
etween them.

The charcoal from lime trees has a great capacity for absorbing ammonia
as, but possesses less power of absorbing this gas when dissolved in water.

The writer concludes from his experiments that the absorption of am-
ıonia gas varies considerably on account of the complex nature of the soil.
t is therefore very difficult to formulate an absorption theory applicable to
ll kinds of soil. However, it seems that the theory of FREUNDLICH accord-
ıg to which absorption is a condensation process occurring at the surface of
he soil particles, is the most probable.

005 – **The Radioactivity of the Soil and the Value of Radium Fertilisers.** — RAMSEY R. R. (Department of Physics, Indiana University) in *Science*, Vol. XLII, No 1076, p. 219. Lancaster, Pa., August 1915.

The writer calculates the amount of radium per acre of the earth's
ırface and the amount of radium emanation passing out from the interior
f the earth.

Taking RUTHERFORD'S average value for the amount of radium in the
ırth's crust as 2×10^{-12} grams per gram of earth, the amount of radium in
ı acre of soil to a depth of 5 inches is about 1 milligram.

The value of the radium emanation from the interior of the earth
estimated at about 1000×10^{-12} curies per square metre per hour or
0003 $\times 10^{-12}$ curies per second which is the amount of emanation continually
ven off by 150×10^{-12} grams of radium.

The amount of radium emanation given off by the soil is 50 to 100
ımes as much as that which is given off by the radium in the upper
inch layer.

Therefore, in order to double the emanation in the soil one must use
ɔout 75 milligrams of radium per acre at a cost of $ 7 500 per acre.

One radio-fertiliser on the market contains from 5 to 8×10^{-8} grams
radium to the pound and the instructions recommend the application of
ɔ lbs. per acre. Thus, the average soil contains ten times as much radium
would be contained in the application.

ɔ6 – **A New Nitrite-Forming Organism.** — JOSHI N. J. (First Assistant to the Imperial Agricultural Bacteriologist) in *Memoirs of the Department of Agriculture in India, Bacteriological Series*, Vol. I, No 3, pp. 85-96, 2 Plates. Pusa, India. April, 1915.

These experiments were begun with the object of demonstrating to
ıdents the method of isolation of nitrifying organisms. The Omélianski
ıtion used was modified by the substitution of calcium for magnesium
ɔonate so as to avoid any inhibition of nitrification as previously no-
d with magnesium carbonate. 1 gram of Pusa soil was used to inocu-
50 cc. of solution. After incubation for 14 days 5 cc. of the liquid was
ınsferred to another flask containing 50 cc. of the sterile solution and

incubated. Six similar transfers of 5 cc. were made and in the last culture a thin pellicle dotted with chalky white prominences resembling the growth of *B. Oligo-carbo-philous* was seen on the surface of the liquid. Microscopic examination showed the pellicle to consist of several kinds of bacteria among which was a mass of ramifying threads. This fluid culture was then plated on silicate jelly and Beijerinck's agar with ammonium sulphate in place of hydrogen ammonium sodium phosphate. No organism grew on either media for the first ten days, after which small white colonies were seen. Microscopic examination showed them to resemble the mass of threads originally found. The addition of ammonium sulphate to these colonies increased their size to about 0.5 cm. in diameter. Inoculation of Omeliansk solution from one of these colonies and incubation at 30° C. for 15 days resulted in the formation of nitrites, but no nitrates were found.

In addition to the mycelium flagellated organisms were also observed. It was found impossible to obtain pure cultures of these two organisms showing that they are forms of the same organism.

Filter pad cultures almost invariably contained colonies of protozoa which could be destroyed by heating to 60° C. The thermal death point of the nitrite forming organism was found to lie between 70 and 80 °C. and the optimum temperature for its activity between 25° to 35 ° C.

The addition of magnesium carbonate in place of calcium carbonate to the culture medium retarded nitrification considerably. An increased proportion of carbon dioxide, up to a certain point, or the addition of coal gas to the atmosphere appears to act as a stimulus to this organism. No growth of the organism takes place under anaerobic conditions. Asparagin and glucose both retard its action whilst urea caused a slight increase in the formation of nitrite. In the presence of ammonium carbonate and urea, calcium carbonate appears to exert an inhibitory influence. In the absence of phosphates ammonium carbonate is the only substance which is easily changed into nitrites.

1007 – **Researches on the Fixation of Potash by Soil Bacteria.** — Kyropoulos, S., in *Zeitschrift für Gärungsphysiologie*, Vol. 5, No. 3, pp. 161-166, Leipzig, July 1915.

The bacteria present in the soil not only decompose the nutritive substances contained in it, but often use some of these compounds as food, to the disadvantage of plants. This has been found to be the case both with nitrogen and phosphoric acid. The writer has endeavoured to determine if the same thing occurs in the case of potash. His work was rendered more difficult by the fact that the bacteria have, in their cellular substance, only a small amount of this element, and it is consequently extremely difficult to prove that they have fixed a portion of the potash of the soil.

Experiments were first begun on soil samples of similar humidity, to which were added variable amounts of potash. Each sample was kept for some weeks at a temperature of from 20 to 25° C., saccharose being added to the soil to promote the growth of the bacteria. The quantity of potash in the sample was then determined to see if it had decreased through fixing by the bacteria. It was found that the potash content of the soil had not

een diminished in this way. The same result was obtained when water ultures were used instead of soil.

008 – **A New Method of Mechanical Soil Analysis.** — SWEN, ODÉN, in *Internationale Mitteilungen für Bodenkunde*, Vol. 5, No. 4, pp. 257-311. Berlin, 1915.

The ultimate object of mechanical soil analysis is the construction of a urve, on the principle of that of MAXWELL, where the abscissa represents a alue having a mathematical relation to the diameter of the particles, and ne ordinate represents a value permitting the calculation of the weight or umber of the corresponding particles.

The construction of such a curve, however, necessitates an enormous mount of work, if the method is adopted of separating the different omponents. The writer tried to obtain an idea of the distribution of ne components, not by the isolation of the various groups, but by tudying a particular character in direct relation to the size (with refernce to the occurrence) of the particles. This character is the rapidity ith which the soil particles settle in water. If the soil sample is well ixed with the water, so that the distribution of the particles is uniform hroughout the liquid, and if it is possible to determine the weight (P) of ne particles sinking to the bottom of the water, in function of the me t, a sedimentation curve can be constructed P (t) depending on the ze, (with reference to the occurrence) of the particles and which is haracteristic for each soil sample. With the help of this sedimentation urve, it will also be possible to calculate the curve for the distribution of the rticles. To determine the rapidity of sedimentation the writer has inented a special method, based on STOKES' equation, with an apparatus *ad oc* consisting mainly of a cylinder 11 $^3/_4$ in. high which is filled with water. bout 2 mm above the bottom a copper plate of about the same diameter the cylinder is suspended by means of thin silver wires to one arm of a very ccurate compensating balance. To the other arm of the balance is attached compensating weight, which can be increased or decreased automatically. determine the speed of sedimentation, a sample of soil is poured into the linder. The soil particles fall through the water and settle on the plate. soon as the sedimentation has begun, the plate falls; shortly after, it rias again, owing to the automatic increase of the compensating weight on the her arm. This process is repeated until all the soil particles are precipited. The increase in the compensating weight thus represents the weight the sample of soil. Synchronously with this operation the time required the soil to sink is determined by a chronograph. Having thus determined e weight of the sediment and the time necessary for it to settle, it is easy calculate the speed of the sedimentation and to represent it by curves. e writer has constructed curves for several kinds of soil and has found that ch has some special characteristic. The new method is very simple, ctical and easily carried out. The writer intends perfecting it and making ther experiments.

1009 – **New Method of Preserving Liquid Manure.** — SCHMOEGER, in *Westpreussische Landwirtschaftliche Mitteilungen.* Year 20, No. 34, p. 34. Dantzig, August 19, 1915.

In the course of research on the manufacture of albumen, the "Institut für Gärungsgewrebe" in Berlin has discovered a new method for preserving liquid manure in the pit. The process is based on the fact that there are in nature, not only lactic acid bacteria capable of preserving forage, but also lactic acid bacteria able to preserve the fresh urine of animals. As these bacteria require for their normal development in addition to a certain amount of nitrogenous matter and of salts, a small amount of carbohydrates in the form of sugar, and as the two first compounds are regularly found in urine while the latter is absent, it is necessary for the normal development of the acid bacteria in the pit, that some sugar should be added to the liquid manure. It has been discovered at the Institute that the amount of sugar necessary for the preservation of 100 tons of liquid manure is 0.5 tons, which represents 3.1 tons of sugar beets.

The ferment for preserving the liquid manure is *Bacillus cucumeris fermentati*, widely used in Germany for preserving potatoes.

In the case of liquid manure, 10 per cent of a broth made from sugar beet is mixed with 90 per cent of water, to this are added pure cultures of the above mentioned bacilli and the whole is thrown into the manure pit. Instead of sugar beets, 5 per cent of molasses can be used, or 10 per cent of a mixture of sweet potatoes.

The liquid manure thus treated contains, after from 1 to 2 days, the maximum quantity of lactic acid necessary for its preservation. In order that the latter may be complete it is necessary for the bottom and walls of the pit to be impermeable, this may be insured by tarring them. In addition, a small amount of oil should be thrown into the pit to prevent the air entering the manure.

The profit realised by this method, through the fixing of nitrogen is, in the case of Germany, about 31 *s* per 100 tons of liquid manure.

The process has been recently recommended by the Ministry of Agriculture to all the local chambers of agriculture (Landwirtschaftskammer). The latter are, at the present time, making practical tests on farms.

MANURES AND MANURING

1010 – **The Solubility of the Phosphoric Acid of Basic Slag in Water Saturated with Carbonic Acid.** — MASHAUPT, J. G. (Kijkslandbouw proefstation te Groningen), in *Verslagen van Landbouwkundige Onderzoekingen der Kijkslandbouwproefstations*, No. 17, pp. 97-135, 15 figs. The Hague, 1915.

In the case of previous work on the solubility of different phosphatic fertilisers in water saturated with carbonic acid, (*Verslagen van Landbouwkundige onderzekingen der Kijksland bouwproefstations* XI, 1912), extraction was made in the proportion of 1 part of phosphatic substance to 500 parts of water. The writer now studies the ratio of slag : water, simultaneously with the solubility of the lime. If it be granted that the quantity of the phosphoric acid of the slag dissolved by means of contact with water saturated with carbonic acid, depends to a great extent on the above-mentioned ratio, this is due to the fact that the narrower this ratio, the more the effect of the free lime and the lime silicates present in the slag makes itself felt. Not

hough attention is paid to this circumstance in the various determinations f solubility made in agricultural chemistry in order to estimate the assimilaon of the phosphoric acid of soils and of fertilisers. The result is that stead of a given amount of phosphates being dissolved, as one believes, in ctuality only an entirely arbitrary portion has been affected. In order herefore to estimate the relative value of the different phosphates with acuracy, the determination of the rate at which solution takes place by means f continued extraction is preferable to the method of intermittent extracion. This method has the advantage of speedily eliminating the dissolved ubstance, although the writer has not yet succeeded in overcoming all the ifficulties entailed by this method.

Thus, in subjecting to continuous extractions by means of water saturated vith carbonic acid, various samples of basic slag presenting considerable ifferences in solubility in 2 per cent citric acid, it would appear that after a ertain number of extractions, (which would remove the initial differences etween the various kinds of basic slag depending on the proportion slag : vater) the solubility of the phosphoric acid while being slightly less than its olubility in Wagner's reagent, would be in the same proportion as in the atter. The writer therefore does not believe that Wagner's method has really een proved to give the relative fertilising value of the different types of basic lag, firstly, because the degree of their solubility in water saturated with carbonic acid has not yet been verified by cultural experiments and, secondly, beause there is no reason to suppose that the only point of importance is the um of the phosphoric acid dissolved in a number of extractions, independntly of the quantities dissolved in the first, second, and subsequent xtractions.

As to the causes to which the varying solubility of the phosphoric acid f basic slag must be attributed, it would appear from the determinations ade that the solubility in citric acid decreases with the increase in free lime. he contrary would occur with lime silicate (in relation to the total amount f silica). However, the differences in the free lime content would only acount to a very small extent for the differences in the solubility of the phoshoric acid, for if the lime is eliminated by a solution of saccharose, it is en that although the solubility of the phosphoric acid, both in water sarated with carbonic acid and in 2 per cent citric acid, is slightly increased, et the considerable differences between the above mentioned samples do ot disappear; further, the differences in the solubility of the silicate of lime eing only slight in the 3 samples, it is not possible to base the different degrees of the solubility of phosphoric acid upon them.

As, in short, the difference in the solubility of the various samples of asic slag cannot be attributed to their lime, or lime silicate, content, or ven to the tenuity of the phosphatic particles, the cause of this difference to be looked for in the phosphate of lime itself, and it very probably deends upon the presence of phospho-silicates of lime, as other writers have lready suggested.

Finally, the writer is of opinion that cultural experiments will be able throw some light upon the question as to how far solubility in water sat-

urated with carbonic acid, whether by intermittent or continuous extrac tion, can be an index of the assimilation of the phosphoric acid by the soil These experiments should be carried out in sand washed with boiling hydro chloric acid.

Further experiments confirm the theory that no definite connectio exists between the lime and silicate content (total silica) on the one hand, an the solubility of phosphoric acid in 2 per cent citric acid on the other ; no has any connection been recorded between the amount of silicic acid solubl in acids and the solubility of phosphoric acid. It has thus been shown tha in every case the silicic acid of the eventual phospho-silicates is not capabl of direct determination. Thus, notwithstanding an almost equal solubilit in citric acid, considerable differences are recorded at the 1st extraction i the solubility in water saturated with carbonic acid. For this reason, th writer considers, that as water saturated with carbonic acid resembles mor nearly, on account of its solvent property, the substances present in the soi and the roots of plants, it is possible that basic slags of the same degree o solubility in citric acid may have a different fertilising value. It should b noted incidentally that a high phosphoric acid content is always connecte with a lower degree of relative solubility, especially in carbonic acid.

1011 – **The Present Condition of the Fertiliser Trade in Denmark** (1). — *Statistiske Efte retninger udgivet of det Statistike Department*, Year 7, No. 10, pp. 65-67, Copenhagen, May 25, 1915. (*Communicated to the International Institute of Agriculture by the Correspondent fo Denmark* Baron Rosenkrantz).

The importation of chemical fertilisers for agricultural purposes i Denmark has developed to an extraordinary extent during the last fe years. The total value of these imports (calculated free of duty at the por of arrival) was £ 200 000 in 1900, over £ 320 000 in 1905, and £ 580 000 i 1910. From the latter year onwards the increase was still more rapid In 1911 Denmark imported fertilisers to the value of £ 728 000, and i 1913 and 1914 to the value of £ 960 000 and £ 1 072 000 respectively. I Table I the importations of the various fertilisers in 1913 and 1914 are ar ranged according to the nature of their principal component, their quantity and value. Amongst phosphatic fertilisers are included, in addition t those ready for use, crude phosphates to be treated in the Danish super phosphate factories. Commercial fertilisers are almost exclusively minera or chemical.

Of the total imports of 1914 (value £ 1 246 760) about $^{9}/_{10}$ belonged to th first two groups (phosphatic and nitrogenous fertilisers) ; $^{1}/_{10}$ to potassi fertilisers and a negligeable quantity to calcareous manures. In this latte group an export of Danish products must be mentioned of which th value sometimes exceeds that of the corresponding imported products

Phosphatic fertilisers. — With the exception of the output of som Danish bone-meal factories (only 400 metric tons in 1914), all the phos

(1) See also in *International Year book of Agricultural Statistics* 1913 1914 publishe by the International Institute of Agriculture, the chapter entitled : Production, Trade an Price of Chemical Fertilisers. (*Ed.*).

atic chemical fertilisers used in Denmark are of foreign origin, for none the phosphatic substances found in the country are, as far as it is known, any use for this purpose. On the other hand, the large importation of ude phosphates proves that the manufacture of phosphatic fertilisers is enormous importance in Denmark. This industry has developed greatly late years despite the fact that in 1913 and 1914 it was impossible to al with all the imported raw material given in Table I, the amount of ude phosphates imported, especially in 1913, being extremely large. In 11, only 20 000 metric tons were imported.

As a complementary substance the superphosphate factories use pyrites; this compound 35 981 metric tons were imported in 1914. The weight superphosphate prepared in the Danish factories considerably exceeds at of the crude phosphates given in Table I.

ABLE I. — *The Importation of Fertilisers into Denmark in* 1913 *and* 1914.

	Quantity in metric tons		Value in pounds sterling	
	in 1913	in 1914	in 1913	in 1914
			£	£
hosphatic fertilisers	—	—	495 550	559 955
Crude phosphate	55 876	49 301	—	—
Superphosphate	110 151	142 883	—	—
Basic slag	8 945	10 751	—	—
Bone meal	282	214	—	—
itrogenous fertilisers	—	—	456 830	555 665
Nitrate of soda	34 930	42 592	—	—
Synthetic nitrogenous fertilisers	5 067	10 760	—	—
Sulphate of ammonia	524	695	—	—
otassic fertilisers	—	—	107 250	108 625
Kainit	9 400	8 383	—	—
Potassic salts, 37 % and over	16 700	15 287	—	—
alcareous manures	—	—	2 475	9 790
Lime	6 490	3 473	—	—
Marl (on the field)	9 021	113 930	—	—
nimal and other manures	85	60	275	220
Totals	—	—	1 062 380	1 234 255

The trade statistics for 1913 show that one ton of crude phosphate is sufficient for the manufacture of 1.92 tons of superphosphate. Presuming (still following the trade statistics) that the fertiliser factories have manufactured from the crude imported phosphates, superphosphates at about 15

per cent, we obtain the data tabulated in Table II, regarding the aver age total amount of phosphatic fertilisers (imported and manufactured i the country) consumed during the last period of two years. The importe superphosphate is almost invariably, under normal conditions, equivalen to 18 per cent.

TABLE II. — *Amount of superphosphates used in Denmark, average for biennial period* 1913-1914.

		metric tons
Imported in the form of superphosphates	about	135 000
Superphosphate manufactured from imported crude phosphate	about	85 000
Total	»	220 000

Only a small quantity of the superphosphate manufactured in th country is exported (7 000 metric tons in 1913 and 2 000 metric tons i 1914).

TABLE III. — *Importation (in metric tons) into Denmark of basic slag and superphosphate in* 1913 *and* 1914.

Country of origin	Superphosphate		Basic slag	
	1913	1914	1913	1914
Great Britain	13 680	18 946	8 755	11 031
Germany	45 924	62 804	60	45
Netherlands	12 035	13 203	—	—
Belgium	20 250	19 367	81	—
Sweden	18 266	28 177	—	—
Other countries, or not mentioned .	—	386	60	—
Totals . . .	110 155	142 883	8 956	11 076

The crude phosphates come exclusively from non-European coun tries (Florida, Tunisia, Islands in the Pacific Ocean) while the ready-mad phosphatic fertilisers are only supplied by the neighbouring countrie as is shown by Table III, which gives the importation (including re-exporta tion) during the last two years' period.

Nitrogenous fertilisers. — Of these fertilisers, until about 2 years ago, n trate of soda was almost exclusively employed in Danish agriculture, i 1911 only 30 metric tons of synthetic nitrogenous fertilisers were importe A large amount of the sulphate of ammonia manufactured in the Danish ga

ctories was exported to Germany, where sulphate of ammonia is relatively uch more used than in Denmark.

In 1914, however, as is shown by Table I, the importation of synthetic trogenous manures amounted to 10 760 metric tons while that of lphate of ammonia was a little less than in the preceding year. Nitrate soda was formerly almost entirely imported by way of Hamburg, but late years, it has been coming through other places or directly from Chili. 1914 the importation (including the re-exportation) of nitrate of soda was vided as follows: through Hamburg 23 488 metric tons, through other erman towns 5 927 met. tons, through England 476 met. tons, directly om Chili 12 852 met. tons. The synthetic nitrogenous fertilisers used in enmark come, almost without exception, from Norway.

Potassic fertilisers. —It is well-known that potassic fertilisers are entire- supplied by German mines. About $^2/_3$ of the potassic fertilisers import- l by Denmark at the present time are, as is seen by Table I, concentrated lts, while kainit (less rich in potash) which first formed the greater part of ie imports, now only represents $^1/_3$ of the weight and a still smaller frac- on of the value of the potassic compounds brought into the country for ma- urial purposes.

Lime fertilisers. — Some thousans of tons of these fertilisers are an- ually imported from Sweden, and Denmark exports to Germany a nearly rresponding amount of lime for manurial purposes. The marl is trans- rted in the particular zones by railways constructed for the purpose, and ie quantity carried is very variable. In 1914, 114 000 met. tons were nported and none was exported; in 1912, only 11 000 met. tons were nported and 91 100 exported.

Table IV shows the monthly distribution of the importation of the ost important fertilisers in 1913, 1914 and the first 4 months of 1915. The 913 distribution may be regarded as normal, as it corresponds to that lculated for the preceding years.

With the exception of crude phosphate, which arrives in a few large nsignments periodically throughout the year, the importation is limited to rtain months. The principal time for the export of basic slag is in ebruary, March and the few following weeks. A shorter, but none the ss clearly defined period, follows in August-September in order to supply ie autumn requirements. In the case of nitrate of soda, the chief im- rtation period is in the spring and corresponds to that of the phosphatic rtilisers, but there is no further importation in the autumn. The great- part of the potassic fertilisers is imported from November to December; is date is, however, not chosen for any particular reasons affecting Danish griculture, but in order to provide a regular market for the produce of ie potassic salt mines.

The importation of potassic salts at the end of 1914, seemed to have en of the same importance as in previous years, and as the importation the other fertilisers takes place principally during the first part of the ar, the amount of fertilisers imported in 1914 was not greatly influenced the war. On the other hand, Table V shows that in the first months of

TABLE IV. — *Monthly Distribution of the Importation of Fertilisers into Denmark.*

	Crude Phosphate			Superphosphate			Basic Slag			Nitrate of Soda			Synthetic nitrogenous fertilisers			Potassic salts (kainit and more concentrated salts)		
	1913	1914	1915	1913	1914	1915	1913	1914	1915	1913	1914	1915	1913	1914	1915	1913	1914	1915
	Metric tons			Metric tons			Metric tons			Metric tons			Metric tons			Metric tons		
January	6 055	3 526	6 087	7 938	3 952	18 509	526	201	1 035	40	—	3 375	5	—	100	166	624	3 785
February	—	3 100	8 327	30 677	50 990	16 558	198	1 605	3 924	5 561	5 073	5 583	516	1 280	63	362	1 146	1 232
March	3 304	3 422	—	35 455	58 143	16 437	2 081	2 316	1 608	13 280	16 900	4 924	3 370	3 638	3 082	2 628	3 508	4 294
April	3 164	3 300	—	9 550	12 142	7 503	471	—	—	10 907	16 018	14 113	1 166	607	211	1 456	1 614	1 719
May	6 439	8 584	—	601	476	—	—	—	—	4 433	3 149	—	—	150	—	130	53	—
June	5 665	9 145	—	24	10	—	—	—	—	528	860	—	—	—	—	450	—	—
July	1 700	—	—	418	98	—	542	25	—	183	266	—	—	—	—	30	111	—
August	1 394	2 794	—	19 236	3 329	—	1 108	200	—	32	1	—	10	—	—	975	277	—
September	6 247	—	—	4 941	7 318	—	1 357	20	—	10	3	—	—	1 662	—	866	953	—
October	7 367	8 005	—	897	384	—	111	2 362	—	10	179	—	—	2 619	—	2 745	3 554	—
November	3 300	4 150	—	—	612	—	1 408	3 778	—	165	294	—	—	400	—	7 744	3 549	—
December	11 240	3 275	—	418	5 429	—	1 154	569	—	—	—	—	—	1 426	—	7 105	8 195	—
Totals	55 875	49 301	—	110 155	142 883	—	8 956	11 076	—	35 049	42 743	—	5 067	11 782	—	26 110*	23 584	—

* In addition, there were imported in 1913 about 1430 metric tons of potassic fertilisers of which it is impossible to determine the monthly distribution.

915, the amount imported was much less than in the corresponding months f the previous years. Part of the lacking foreign fertilisers was replaced y the supplies stored by the Danish industry, and to compensate for the nports of nitrate of soda that were partially wanting in February and larch, there were, as far as can be made out, some belated consignments in lay. In any case, the total available supply of the two chief groups of ertilisers was smaller in the spring of 1915 than in previous years. Owing o the war the 1915 imports only came in part from the usual countries of upply.

There have been also further changes in the normal conditions during he war; amongst others, part of the imported superphosphate has had a ower value than 18 per cent.

012 – **On the Presence in Plants of Hematoid Compounds of Iron.** — GOLA, G., in *Atti della Reale Accademia dei Lincei*, Year CCCXIII, Series 5, Comptes-rendus, Vol. XXIV, Part. 12, 1st Half-Year, pp. 1239-1243. Rome, July 10, 1915.

After reference to the work of other writers (PETIT, STOKLASA, TARBOURIEH and SAGET) and to his own previous researches, the writer describes the method by which he succeeded in extracting from numerous plant substances (sawdust, the bark of poplar and alder, leaves of *Parietaria officinalis*, dried and unfermented meadow grass, beer yeast, *Lacterium conversus*, and *Penicillium glaucum*) organic iron compounds all of very similar composition.

The impure matter rich in iron was obtained by macerating the vegetable substance in a solution of hydrate, or carbonate, of sodium, separating the extract by displacement, acidifying with acetic acid and collecting the precipitate thus obtained. By a series of operations this precipitate was fractionated into 4 parts: 1) soluble in alkaline alcohol (alcoholic solution of potassium); 2) soluble in glacial acetic acid; 3) insoluble; 4) inorganic; 100 kilos of poplar saw dust gave 170 gr. of crude iron compound; 100 kilos of dry grass yielded 430 gr. of crude product.

The characters of the compounds thus obtained and the methods followed, lead to the supposition that the metal in these compounds is combined in very similar, if not identical, manner to that constituting the fundamental nucleus of the hœmatin of the blood.

013 – **Concerning the Distribution of Cyanogen in Grasses, especially in the Genera *Panicularia* or *Glyceria* and *Tridens* or *Sieglingia*.** — ALSBERG C. L. and BLACK O. F. (Office of Poisonous Plant, Drug Plant and Physiological Investigations, Bur. of Plant Industry, U. S. Department of Agriculture, Washington) in *The Journal of Biological Chemistry*, Vol XXI, N° 3, pp. 601-609. Baltimore, Md., July, 1915.

The investigation reviewed is the beginning of a survey for hydrocyanic acid in the grasses of the United States.

Twenty-two species of American grasses were tested for cyanogen. Of these, cyanogen was found in *Tridens flava* Hitchcock, *Panicularia nervata* (Wild.) Ktze., *Panicularia grandis* Nash, and *Panicularia canadensis* (Michx.) Ktze. Three other American species of *Panicularia* examined, *pauciflora* Ktze., *fluitans* Ktze., and *septentrionalis* Bickn., did not contain

it under the conditions of the examination. *Stipa Vaseyi*, sleepy grass c the Southwest, generally regarded as poisonous, contained no cyanoger

1014 – **Light and the Rate of Growth in Plants.** — Mc Dougal, D. T. (Desert Botanica Laboratory), in *Science*, New Series, Vol. XLI, No. 1056, pp. 467-469. Garrison-on-Hudson March 26, 1915.

A study of the development of about a hundred seed-plants in dark ness in an equable temperature chamber from 1900 to 1903 in the Nev York Botanical Garden gave foundation for the following statement :

The failure of a large proportion of the forms examined to make a accelerated or exaggerated growth when freed from the influence of light even when provided with an adequate food-supply, shows that light ha no invariable or universal relation to increase in length, or thickness or t the multiplication or increase in volume of separate cells (1).

Precision appliances for the measurement of illumination and of othe environmental conditions in daylight were not available at that time, and i was therefore not possible to follow the contrasting reactions which accom panied illumination and shading of the large plants which were the subject in the extended experiments. In one series, however, the peduncles an scapes of *Arisaema* nearing the end of their period of elongation showe an initial acceleration when light was totally excluded from the plants This acceleration reached its maximum in twenty-four hours, then de creased to a minimum equivalent to the original rate in about four time this period.

Blaauw's results (2) confirm the writer's thesis that light does not exer cise a constant or invariable effect on growth. Furthermore, Blaauw's experi ments by which sporangiophores of the mould were exposed to illuminatio from four or eight sides, with controlled intensities, demonstrate that th first reaction of this organ to a sudden illumination is an accelerated rat of growth, followed by a gradual decrease from which a recovery is made t the original rate. It is to be seen that the general mode of change is sim lar to that of massive organs deprived of light as described above. Further more, the indirect effect of light in conditioning differentiations of tissue and thus affecting growth-elongations was pointed out.

The elongation or enlargement of a cell or of any structure like that o the sporangiophore of *Phycomyces* may be taken as the expression of in equality between the extensibility of the cell material, and its membrane and of some internal expanding or stretching force. The osmotic pressur of the contents of the vacuoles, or of solutions filling the protoplasmic in terstices has hitherto been relied upon to furnish the necessary force o growth.

(1) Mac Dougal, « Influence of Light and Darkness on Growth and Development » *Mem. N. Y. Bot. Garden*, 2, pp. 307-308, 1903.

(2) Blauw, « The Primary Photogrowth Reaction and the Cause of the Positive Photo tropism in *Phycomyces nitens* », *Kon. Akad. van Wetensch. te Amsterdam, Proc. of Meet* January 31, 1914. — Blauw, « Licht und Wachstum », *Zeitschrift. f. Botanik*, Hft. 8, 1914.

Borowikov has recently established a parallel between the growth of ertain seedlings in known definite solutions and the hydratation of colloids the same solutions. This writer is therefore led to believe that the retching force of growth ls not osmotic by hydratation pressure, and he elegates osmotic pressure, turgidity and its corollaries to an inconse-uential place in the entire matter (1).

Several features of the growth and hydratation of cacti are not without nportance in connection with any consideration of this matter. The esearches of Richards and of Spoehr at the Desert Laboratory show that ne acidity (malic and oxalic) of the sap of cylindropuntias and platypun-ias decreases from its maximum at daybreak to a minimum at about 4 . m. in the open. The decrease has been shown to be due to the conjoint isintegrating action of temperature and chiefly of light. The calibrations nade by E. H. Long (paper now in press) brought out the fact that if small ylinders were cut from the bodies of these cacti in series beginning at day-reak and extending to the period of minimum acidity, the hydratation ca-pacity of the pieces increases independently of osmotic pressure throughout he day and is greatest in those which have been taken from the plant at he time when collateral tests would indicate the lowest acidity.

Extensive auxanometric records of *Opuntia Blakeana* made chiefly in March and April show that the growth of the enlarging joints is at a mini-num in the morning, with a rapid acceleration parallel with the rising emperature of the open, reaching a maximum about noon and then de-reasing to a minimum before 3 p. m. The curves of decreasing acidity and ncreasing hydratation capacity are symmetrical through the range of aci-ity from N/10 to N/20 according to available data obtained from these lants, and would probably sustain a similar relation in weaker solutions f the acidity were reduced still further.

From the records cited above however it is to be seen that the accelera-ion of the rate of growth does not follow that of hydratation to its custo-nary daily maximum. Whether this divergence is due to a shrinkage fol-owing a heightened water-loss is not yet known. An ample supply was vailable to the absorbing surfaces within a few cm. of the expanding mas-es of cells, but local transpiration may have resulted in actual shrinkage. The optimum temperature for this plant is also a feature not yet deter-nined.

The growth of the opuntias, therefore, takes place during a period of ecreasing acidity resulting from the disintegrating action of light and ris-ng temperatures. This statement applies not only to the diurnal behaviour f the plants during the growing season, but to the growing season as a whole, which, as H. M. Richards has pointed out in a paper now in press, is one of iminishing acidity. The acidities of the cacti are calculated for the sap of he plants. The acidities of N/100 to N/3,000 found by Borowikov to be avourable for hydratation and growth were of the culture solution ; that f the sap of the seedling used was probably still much lower.

(1) Borowikov « Über die Ursachen des Wachstums der Pflanzen », *Biochem. Zeitschrift*, 8 : pp. 230-46, 1913.

Light and temperature in lesser degree are seen to exercise a totalize releasing effect on growth, coincident with reduced acidity and increase hydratation, to a certain limit. Beyond this growth rate is checked. Fu ther analytical tests will be necessary to determine the limiting factors.

1015 – **The Influence of Radio-Active Earth on Plant Growth and Crop Production.** – Rusby, H. H. (Dean of the College of Pharmacy, Columbia University) in *Journal of t New York Botanical Garden* Vol. XVI, No. 181, pp. 1-23, Plates CXLII-CLI. Lancaste Pa. January 1915.

The radio-active material used in these experiments was obtained fro the Standard Chemical Company of Pittsburgh, Penn. and consisted o the finely powdered residue remaining from the radium ore after extrac tion and containing from 2 to 3 milligrams of radium per ton.

The first experiment was made on radishes growing in a window-box. Th powder was applied at the rate of 16 grains per square foot between tw rows of radishes 4 inches apart. The treated radishes soon appeare much inferior to the untreated and on weighing, the green tops of th former weighed 17 per cent. less than those of the latter whilst the root weighed about 20 per cent. more. Thus, it appears that under the in fluence of radium, it required less green leaf surface for assimilation.

These boxes were then sown with cabbage and tomato seed and ge mination took place one or two days earlier in the radium treated soil.

A series of experiments were conducted in a garden of 1½ acres wit turnips, carrots, tomatoes, water-melons, celery, onions, peas, grasses, et The radio-active earth was mixed witha chemical fertiliser which was th same in all cases. Every operation of seeding, hoeing, cultivating, et was performed across all five plots at once. The radio-active mixture wa sowed equally over the surface and dug in, except in one case where it wa applied in the rows for comparison. The quantity of mixture applied va ried from 25 to 200 lbs. per acre.

Nearly all the field crops gave an increased yield under the influenc of the radium, the largest gain being 129 per cent. The optimum amoun of the mixture varied with the different crops, and families of plants showe the same varying susceptibility.

The first effect of the radium is to increase root growth whilst the ste may be retarded for a time and later undergo a great acceleration of growt The edible properties of the products were improved *e. g*, potatoes becam more mealy, roots more tender and of finer flavour. Tomatoes were sweet and chemical analysis showed them to contain less water and more suga

In the case of turnips a much greater increase in weight of the root occurred in the case of the long rooted " cowhorn " variety than with th globe variety. Thus, the larger the amount of root surface exposed t the soil the greater the effect of the radium. The root is more liable t become radio-active owing to the absorption of radio-active water whic exerts a continuously stimulating action on the root cells.

The resistance to fungous diseases was not always affected in the sam manner by the radium. Cucumbers and squashes were rendered more suscep tible whilst melons, tomatoes and eggplants become more resistant.

The beneficial effects of radium applications continue over successive crops and the largest amount required by any crop would cost less than the increased market value of such crop of the first year. Its use does not decrease the necessity for fertilizing the soil except in the case of virgin soils where ample reserves of plant food exist.

1016 - **Action of Radium on Vegetation.** — *The Gardeners' Chronicle*, Vol. LVIII, No. 1494, p. 102, 1 fig. London, August 14, 1915.

Experiments are being conducted by MARTIN H. F. SUTTON at Reading on the action of radio-active ores on garden crops. They have shown that, when radio-active ore is mixed with the soil, the germination of rape seed is accelerated. This year the effect of putting the radioactive ore in glass bottles in the soil was determined.

Three large flat boxes each 3 feet square and 6 inches deep were filled with garden soil placed 15 yards apart and sown with rape seed. One box was used as a control, in another a bottle containing about onefour-thousandth part of a milligram of radium bromide was buried in the centre, and in the third two similar bottles were buried at the two opposite corners of the same diagonal. Up to the 11th day after sowing the boxes containing the radium showed superior growth to the control but after 17 days they began to lose vigour and after 40 days the contrast was very marked. The plants subjected to the action of the gamma rays showed no excessive development of their roots. The gamma rays therefore appear to have a distinctly injurious or inhibitory action on the growth of plants.

1017 - **The Part Played by Chlorophyll in Plants.** — MAZÉ P. in *Comptes Rendus de l'Académie des Sciences*, Vol. 160, No. 23, pp. 739-742. Paris, June 7, 1915.

The writer studies the relation between chlorophyll and the activity of the plant, and endeavours to determine experimentally the part played by this substance. He carried out a series of experiments with 4 maize plants. Of these, two were grown in a nutritive solution consisting of 0.5 gr. sodium nitrate, 0.5 gr. bipotassic phosphate, 0.1 gr. sulphate of magnesium, 1000 gr. spring water. The two others were grown in a solution containing the same compounds but at ten times the concentration, as the nutritive solution evaporated more was added in order to maintain the liquid at the same level. Three tables give the amount of the water evaporated by the control plants and by those growing in the concentrated solutions, during a period of 48 hours, as well as throughout the experiment, in addition to the amount of water evaporated per kilogram of dry weight of the plants and the losses in weight due to diurnal and nocturnal transpiration. At the end of the experiment, the terminal leaves of the plants in the concentrated solutions were chlorotic; on the other hand both the weights of solution evaporated and the expenditure of heat were in the proportion of 2 to 1.

This difference cannot be attributed either to the chemical work of the plant resulting in the absorption of heat or to external conditions, since the plants were placed side by side. Further, it is not due to a difference in the evaporating surface, since the development of the two plants remained the same till June 24, the date at which the comparison was begun

between the diurnal and nocturnal transpiration of the two groups. The difference must be dependent on the calorific energy due to the transformation of the solar rays by the chlorophyll and a decrease in the plant's activity must cause a discoloration of the green organs, such as occurs in the plants growing in the concentrated solutions.

Whatever may be the cause, the chlorosis is a means of defence assumed by the diseased plant against an excessive increase in temperature. Being unable to assimilate the carbon of the carbon dioxide, the plant, in order to live in sunlight is obliged to part with its chlorophyll.

From the fact that the control specimen, in order to gain 2 gr. of dry weight, absorbed 8 calories, *i. e.* $\frac{1}{22.5}$ of the heat required to evaporate the water, and in view of the physiological meaning of chlorosis just discussed, the writer is of opinion that it is rash to attribute to chlorophyll an immediate action upon the chemical changes governing carbonic acid assimilation. The pigments of the higher plants play a purely physical part.

1018 – **The Influence of the Pyrrolic Nucleus on the Formation of Chlorophyll.** — POLLACCI, GINO and ODDO, BERNARDO, in *Atti della R. Accademia dei Lincei*, Vol. XXIV, Part 1, pp. 37-39. Rome, August 6, 1915.

In order to understand better the part played by chlorophyll in plant life and its parallelism with the haemoglobin present in the blood of vertebrates, it was judged necessary to take into consideration, not only the two metallic elements, which constitute the respective molecules (magnesium and iron), but also the pyrrolic nucleus of the organic part of the molecule.

The writers therefore studied the effect of a pyrrolic compound in the formation of the colouring matter of leaves, as in this case the individual and combined action of some elements (not excluding magnesium) is already known.

Experiments were made upon *Zea mays* with the magnesium salt of a pyrrol-carbonic acid, after a preliminary test had fixed the plant's limit of toleration at 0.5 per thousand. The salts and water used were entirely free from iron. The nutritive solutions were prepared with a base of nitrate of calcium, sulphate of ammonia, nitrate of potassium and acid phosphate of potassium ; the pyrrol-carbonate of magnesium being added in the proportion corresponding to the amount of magnesium generally used, *viz.*, 0.0247 gr. per thousand. The seed experimented upon produced a plant with all its leaves of normal green colour ; thus, formation of chlorophyll was obtained in plants growing in soil devoid of iron. This is a completely new occurrence.

1019 – **The Parasitisation of Seeds ; its General Biological Importance.** — GALIPPE, V., in *Comptes Rendus de l'Académie des Sciences*, Vol. 161, No. 5, pp. 112-115. Paris, August 2, 1915.

The researches summarised in this communication are a continuation of those published by the writer from 1887 to 1891 dealing with the presence of micro-organisms in plant tissues. They establish the fact that a considerable proportion of normal seeds may contain varying numbers of parasites.

The experiments have shown that:

1) Parasites are present in the anthers and on the pollen, as well s on the stigmas, within the style and the ovary.

2) They have been introduced into the seeds at fertilisation. It is a uestion of old spores ; this explains their slow development in the cul- ural media with the methods employed.

The writer consideres that the teratogenous power of these parasites ould be studied experimentally ; this would help to explain the nature f the external causes of sudden mutations and the alternations of sta- ility and mutability occurring in plant species.

020 - **The Exchange of Ions between the Roots of *Lupinus albus* and Culture Solutions Containing Two Nutrient Salts.** — TRUE R. H. and BARTLETT H. H. (Office of Plant Physiological and Fermentation Investigations, Bureau of Plant Industry) in *American Journal of Botany*. Vol II, N° 7, pp. 311-323. Lancaster, Pa. July 1915.

This paper deals with the antagonism between the nitrates of calcium, nagnesium and potassium in modifiying root absorption. The same test plant *Lupinus albus* L. was used throughout the investigations.

Four groups of solutions were prepared each of which consisted of five hemically equivalent solutions graded from pure calcium nitrate to pure otassium nitrate or magnesium nitrate. Each member of a group had he same NO_3 concentration and approximately the same electrical conduc- ivity. The concentrations of the groups formed a series beginning with istilled water and increas;ng by 120 $N \times 16^{-6}$. The increase or decrease n the electric conductivity of the solutions was determined daily for a pe- iod of two weeks.

The chief results obtained in these investigations are summarised by he writers as follows :

1) When the nitrate of calcium, magnesium and potassium are offer- d in pairs in solutions varying in concentration from 120 $N \times 10^{-6}$ to 80 $N \times 10^{-6}$ the roots generally absorb more electrolytes than from pure solu- ions of salts. For this range of concentration absorption tends to increase ith increase in salt content. The case of magnesium salts offers an ex- ption owing to the narrow range of physiologically useful concentrations f the magnesium ion.

2) In mixtures of calcium and potassium nitrate the inimical effect f K ions on root absorption is indicated by the high ratio of calcium to otassium to give maximum absorption ; viz : 3 Ca $(No_3)_2 \times \frac{1}{4}$ K N O_3 in ll concentrations used.

3) In mixtures of calcium and magnesium nitrates the greater absorp- on of the Mg ion in comparison with the K ion appears in the smaller mount of calcium in the most favourable ratio. The great significance f even a small proportion of calcium is seen in the relatively high absorp- on made in a mixture containing 1 Ca to 9 Mg at the highest concentra- on.

4) In pure solutions the Mg ion is much more favourable to absorption han the K ion in the weaker concentrations while the K ion is more favour- le in the highest concentration. They are absorbed to about the same

extent at a concentration of 360 N × 10^{-6}. Absorption from mixtures exceed that from either pure solution except in the weakest concentrations. Th general tendency of the results seems to indicate that a high proportio of magnesium is more favourable in weaker concentrations.

PLANT BREEDING

1021 – **Researches into the Segregation of Characters in Wheat Hybrids in the F_2 an F_3 Generations.** — HENKMEYER, AUG. in *Journal für Landwirtschaft*, Vol. 63, No. pp. 97-124. Berlin, July 31, 1915.

In considering Mendel's law, it has been stated that in the wheat ea the characters, "beardless", "hairy" and "brown glumes" are dominant while the characters "bearded", "glabrous" and "white glumes" are reces sives. These 3 pairs of factors were studied by STRAUS from 1912-1913 i the case of 32 different crosses from the point of view of the 1st generatio He recorded the following facts: 1) The characters "brown glumes" an "bearded ear" are not always dominant, but the number of dominant case is so large that it is in fact possible to speak of the dominant nature o these 2 factors; 2) the character "beardless ear" is not dominant, bu recessive; it however gives some individuals resembling more closely th beardless forms,

The writer has studied, in 6 hybrids obtained by STRAUS, the above named characters in the 2nd and 3rd generations. The hybrids used we the following:

Females		Males
1 Greek wheat, white and velvety	×	Brown Bestehorn Dickkopf.
2 Red Frankensteiner	×	Greek wheat white and velvety.
3 Greek wheat, white and velvety	×	Red strawed.
4 Red strawed	×	Greek wheat, white and velvety.
5 Greek wheat white and velvety	×	Red prolific.
6 Red prolific	×	Greek wheat, white and velvety.

The seeds were sown in the experimental garden of the Universit of Göttingen in 8 beds of 20 rows each. They germinated well, bu a large number of the seedlings were injured by the winter cold. Toward the 15th of August, the ears were gathered, dried, and studied as regard the presence of awns and hairs and the colour of the glumes.

The most important results obtained with plants of the F_2 and I generations were the following:

Each factor, studied separately, is reproduced according to Mende in the proportion 3: 1, its reproduction is independent of the other facto reproduced at the same time. The combined characters are reproduce regularly in the ratio 9 : 3 : 3 : 1, when it is a question of a combination 2 characters, and the ratio 27 : 9 : 9 : 9 : 3 : 3 : 1, when it is a question of th combination of 3 factors. In the 5th and 6th crossings, this last proporti is not recorded, because the brown colour of the glume of "Red Prolific is produced by a large number of brown factors. The segregation of th 3 characters doubtless gives an intermediate type. This is partially co firmed by the result obtained from the segregation of the characters of th

lf-bearded plants in the F_3 generation. It is consequently impossible to tinguish with the naked eye the "half-bearded", "half-hairy" and "half-own" individuals produced by a heterozygotic cell from the "beardless", iairy" and "brown" individuals produced by a homozygotic cell. The o groups meet and we thus have a case of the phenomenon which VON SCHERMAK calls "prevalence". There is, on the other hand, avery clear aracterisation in the case of "the bearded glabrous" groups and to a rtain extent also in that of the "white glume group. The factors eardless", "hairy", "brown glume" are thus of a "prevalent" or minant nature, while the "bearded", "glabrous" and "white glume" iaracters are recessives.

22 – **The Results of Exercising Selection with Maize** (1). — POWELL, B. E., in *The Country Gentleman*, Vol. LXXX, No. 32, pp. 1257 and 1274. Philadelphia, August 7, 1915.

Maize is very faithful in its manner of responding to systematic selec-on, as is shown by a series of experiments made at the Agricultural Expe-ment Station of the University of Illinois.

The experiments were begun in the autumn of 1902 under the direction Dr LOUIS H. SMITH. The purpose was to see whether, by selection, maize rs could be induced to grow high or low on the stalk. From an ordinary eld of Leaming maize, two sets of ears were chosen, one representing ears owing high on the stalk, the other ears growing low on the stalk. Ever since, e high ears and the low ears have been the subjects of experiment.

The plots are planted an ear to a row; 24 rows are planted in each ot. Self-fertilisation is prevented by detasselling the alternate rows, and ur seed ears are taken from each of the six best detasselled rows. The der of planting the following year is arranged with reference to the re-tionship of these seed ears, to avoid close breeding as far as possible.

The observations made on the plants have included the following points: ight of ear; total length of stalk above ground; node at which the ear borne, counting from the stalk upwards; the total number of internodes the stalk. By continuous selection it has been found that there is an tual shifting of the type itself, gradual, progressive and steady. In 1912, rs in the high-ear strain were borne 78 inches from the ground, hereas ears in the low-ear strain came 25 inches from the ground.

During this selection work it was found that the high and low ear strains re not only differentiated by position on the stalk, but also by their time maturing. The low-eared plants always flowered first and, after some ars of selection, their tassels were already well-developed before tassels peared at all on the high-ear stalk.

Early varieties of maize are characterised by relatively small plants, th few and short internodes and with fruit borne low.

The principle that early maturity is associated with low-growing habit s been observed in other crops. In breeding cotton, where early maturity desired in order to escape boll-weevil (*Anthonomus grandis*) damage, it

(1) See also *B.* 1911, No. 1654; *B.* 1912, Nos. 646, 907, 1031, 1409, 1410; *B.* 1913, Nos. 491, 7, 928; *B.* 1914, Nos. 25, 225, 423,; *B.* August 1915, No. 800. (*Ed.*)

has been found that earliness can best be secured by selecting plants of low-growing habit, with few and short internodes and with the bolls borne low.

The low-ear plots of the Illinois Station have proved most satisfactory from the standpoint of yield. An average of three years for the high-ear plot was 65.9 bushels ; for the low-ear plot 66.9 bushels. This indicates that by judicious selection of good seed ears, it is quite possible to maintain the rate of yield from the low-ear type.

In order to induce quicker maturity, the average maize-grower chooses his seeds from the smaller ears. This is a mistake, for it is the ears of the lowest plants that should be selected.

Other characters of maize have been made the basis of experiment by the Illinois station. Among them are oil content, protein content, the angle of declination of the ear with the stalk and the production of two eared stalks.

Dr. CYRIL G. HOPKINS began experiments in 1896 to determine whether the chemical composition of maize could be influenced by selection. Selections were made for four characteristics : High oil and low oil content, high protein and low protein content (1).

The original seed was provided by 163 good ears of a local strain known as Burr's White. In the 4th crop the type had shifted so much that two types were already obtained and the individuals with the highest oil content of the low strain no longer overlapped the individuals of the lowest oil content of the high strain. In the seventh year the oil content of the entire low oil crop dropped below that of the lowest ears of the original crop and in the ninth year the oil content of the entire high oil series was above that of the highest ear of the original stock. For while the latter contained 4.7 of oil, the low-oil maize, after 17 years of selection, contained 1.9 per cent, the high oil crop contained 8.15 per cent.

The experiments that led to the establishment of high and low protein strains followed the same general principle. The response to selection in the low protein maize was the least prompt of all. At the start the maize contained 10.9 per cent protein. By continuous selection for higher protein content there was produced after 17 years a strain that contained 14.83 per cent. On the other hand, selection produced a low protein strain that contained 7.71 per cent.

A decided difference in the angle of declination of ear with stalk was brought about by selection. It was interesting that the ear developing the greater angle also developed the longer shank. The declining ear has an advantage over the other in that it is better protected from the rain and hence less liable to decay.

Selection for two-eared stalks was begun in 1914 from a field of ordinary maize in which 2.5 per cent of the stalks were found to bear more than one ear. Following this tendency of multiple ears, 62 per cent of the stalks bore 2 ears in 1912. In 1913 this proportion fell to about 25 per cent, due probably to the extreme drought of the season.

(1) See also *B.* August 1915. No -800 (*Ed.*)

23 – **On the Genetics of "Rogues" among Culinary Peas.** — BATESON W. (Director) and PELLEW CATHERINE (Minor student, John Innes Horticultural Institution) in *Journal of Genetics* Vol 5, N° 1, pp. 13-36, Plates 8-12. Cambridge, July 1915.

The genetic relations of rogues among typical varieties of culinary eas has been under investigation during several years at the John Innes orticultural Institution but the main problem still remains to be solved. he term "rogue" is applied by English seed growers to any plants which do ot come true to the variety sown and may generally be accounted for by ixing of the seeds, cross-pollination or the recurrence of a recessive form. he occurrence of these particular rogues, however, cannot be explained by ny of these methods. They are distinguished by the smallness of their ppendicular parts. They are as tall or even taller than the types, but heir stipules, leaflets and petals are comparatively small and narrow.

In the particular types used in these experiments (Duke of Albany nd Early Giant) the white marbling of the foliar parts due to air spaces nder the epidermis is less developed in the rogues. The pods are charac-erised by the upward curve along the dorsal suture. These difference shape between the rogues and their types are evidently all expres-ons of differences in proportional growth along the several axes and the riters consider them as various consequences of a deficiency of extension the foliar parts in the rogue.

The seeds of the rogues are not distinguishable in shape and colour hough they are of a smaller size. Their starch grains are identical with hose of the types and chemical analysis reveals no consistent difference, hough they are less sweet to the taste.

Investigating the production of rogues by the types it was found that he proportion of rogues is smaller among plants raised from the largest eds. The average weight of well-developed seeds in D. A. was 0.41 gm. for he types and 0.37 gm. for the rogues, and in E. G. 0.41 gm. for the types nd 0.34 gm. for the rogues. Thus, by choosing only the finest seeds the gues could in general be avoided, but genetic purity cannot be attained nce many type seeds fall much below the rogue average and occasional eds of the rogue type surpass the type average.

The writers find that the whole course of evidence as to the production these rogues is quite inconsistent with the supposition that the rogues pear as regular recessives in the ordinary sense, since a strain may reed true for a time and the throw rogues. Nor is it likely that such gues have been introduced by insect fertilization, although accidental oss fertilization does occur with great rarity. The rogues are utterly like any modern variety and great efforts are made to exterminate them.

Breeding experiments show that these rogues always breed true and e incapable of throwing any higher form. In the case of Early Giant intermediate type between the rogues and the variety type often occurs. ey possess the foliage of the latter and the curved pods of the former. me of these larger leaved rogues throw a great majority of the ordinary all leaved rogues and these always breed true. Others produce all three es. Thus, without crossing the variety type may produce intermedi-

ates which in their turn can by self pollination produce types. On account of the rarity of the aberrant individuals of the various classes collectively and of the numerical relations of the aberrant classes to each other it is not possible to devise any satisfactory hypothesis of factors to account for the occurrence of these rogues.

The evidence suggests that there is a gradation in genetic proportion from the types which breed approximately true to the intermediates which throw a large majority of rogues.

Crosses between types and rogues always breed true to rogues, thus the type elements received by the hybrid from its type-parent must be permanently lost. Since the F_1 plants resemble the type-parents in their early stages it is suggested that the parental-type elements are consumed during the early stages of somatic development.

This phenomenon may be compared with that of plants which produce from root cuttings forms different from those arising by the propagation of shoots or buds.

Results obtained this year (1915) show that a crossbred plant registered as a rogue produced a branch type-like in character, the seed of which has given rise to both types and rogues. This is a case giving actual proof that a plant may be a true mosaic of rogue and type.

1024 – **Single-Germ Beet Seed.** — TOWNSEND, C. O. (Bureau of Plant Industry U. S. Department of Agriculture) in *The Journal of Heredity*, Vol. VI, No. 8, pp. 351-354, 1 fig. Washington, D. C., August 1915.

With a view to saving the costly operation of hand thinning in sugar beet growing, an attempt has been made to produce a strain of sugar beets that will bear only separate seed-germs instead of the seed balls containing several germs.

More than 95 per cent. of the beet seed of commerce is composed of multiple-germ seed balls of from two to seven germs per ball which are so closely welded together that they cannot be separated without injury to the germ, while only less than 5 per cent consists of single germs. The writer succeded by selection in strongly increasing this character. The work commenced in 1903. Roots were grown from seed known to contain but a single germ, they were stored at the end of the first year and planted out the second season for seed production. Hence, the first crop of seed produced from single-germ seeds was in 1904. There was a wide variation in the percentage of single-germ seeds on the various seed producing plants in this experiment. The most promising plants were covered with closely woven cloth bags to prevent crossing with the other plants. Further, to insure the isolation of single flowers, all clusters of buds were carefully removed from some branches and the remaining buds were covered with paper bags, to prevent them from becoming pollinated with pollen from flower clusters. In many cases the pistils of the single flowers thus isolated were hand pollinated with pollen from flowers standing alone, sometimes on the same plant bearing the flower to be pollinated, sometimes from other plants. The work of hand pollinating was done under tents to guard further against unfavourable crossing.

Subsequent improvements have shown that in spite of all these pre-utions it was possible for unfavourable crosses to have been made by inute insects. However, of the several hundred roots produced from ngle-germ seeds over fifty produced upwards of 25 per cent single-germ eeds.

In the second generation the number of single-germ seeds was up-ards of 50 per cent. on the best plant, and in the third generation it was bout 75 per cent. Now, the selected plants are producing about 75 per ent of single-germ seeds. This tendency to separate the flowers and there-y to produce single-germ seeds seems to be transmissible from parent o offspring. The indications are that this character will become fixed, ut time only will prove it to be so.

025 – **Heredity Types of Inflorescence and Fruits in Tomatoes.** — CRANE M. B. (John Innes Horticultural Institution) [in *Journal of Genetics* Vol. 5, No. 1, pp. 1-11, Plates I-VII. Cambridge, July 1915.

The plants grown in these experiments were raised from one original ross, namely "Wonder of Italy" ♀ × "Lister's Prolific" ♂.

The female parent "Wonder of Italy" is characterised by a type of nflorescence known as "compound" and having a long vegetative period uring which it may produce a mass of growth 3 to 4 feet wide with flowers nd fruits in all stage of growth. The axis of the inflorescence does not reak away at the internode as in the simple type but only at a node, thus nowing the terminal character of the inflorescence. The fruit of this va-iety is small and elongated with two cells.

The male parent is characterised by the simple type of inflorescence hich breaks away in the internode and produces about 9 flowers. The uit is round and many celled, but exhibits considerable variation in iese characters. Fruits with only 2 cells are inclined to be conical in iape, and those with a greater number of cells are more flattened.

Sixteen F_1 plants were grown and the simple type of inflorescence was mpletely dominant.. Each plant matured an average of 50 fruits of a iiform conical shape and bilocular. Occasional fruits were found which ere round and 3 or 4 celled. Of the 63 F_2 plants grown the following ear 41 had simple inflorescences and 12 compound, thus showing the Men-elian ratio.

The shape of fruit was examined in two crops of F_2 plants compris-g 102 individuals.

Classifying the fruits into two groups: short (including conical and round) id long, the numbers were 78 to 24 or approximately a 3 : 1 ratio. Thus, ng fruit and compound type of inflorescence are both recessives. Combi-ng the F_2 results for both pairs of characters the ratio becomes :

AB	*Ab*	*aB*	*ab*
91	16	11	13

here A is the simple type of inflorescence and B the factor for short fruit) us showing a considerable divergence from the 9 : 3 : 3 : 1 ratio. This

suggests partial coupling between the factors for simple inflorescence and for short fruit, though the numbers are inadequate to form a conclusion as to the intensity of the coupling.

In the F_3 generation all the compound types bred true, showing them to be true recessives. With regard to shape all the long fruited types bred true to length but were not always constant in shape. Several pyriform types appeared in F_3 generation in ratios which showed them to be recessives. One F_2 plant with conical bilocular fruits produced F_3 plants bearing four distinct shapes of fruit — conical, round, long and plurilocular compressed fruits in the following ratio:

conical		round		long		compressed round.
29	:	6	:	14	:	3

Thus, the compressed round type appeared in recessive numbers, *i. e.* approximately 1 : 16. Evidently, the long members of the family contain one factor B, the round contain the other factor A and the conical contain both factors.

It also appears that the shape of the fruit and the number of locul are correlated and that in the absence of the factor B, the fruit is plurilocular, but that when A is present as in the round fruit, there are not so many cells as when both A and B are absent as in the compressed round fruits.

All the F_3 families illustrated in this paper were homozygous for the compound type of inflorescence and it is expected that some of the types such as those with compressed round fruit will prove of economic value. Theoretically they should also be homozygous for fruit shape since the compressed round is a recessive character.

1026 – **Work Done by the Minnesota State Fruit-breeding Farm.** — Wilcox, R. Selden in *The Country Gentleman*, Vol. LXXX, No. 31, pp. 1228-1229. Philadelphia, July 31, 1915.

The first State fruit breeding farm in Minnesota was founded about six years ago on the shores of lake Minnetonka under the management of Mr. Charles Haralson. He has already accomplished some important work and given the institution considerable development, as it is already producing some 70 000 seedlings annually and its area, at present eighty acres, will soon be increased by forty or fifty acres more.

The apple is the most important fruit in Minnesota and it has received the most attention from the breeder, with the object of obtaining by crossing and selection a hardy tree that will bear the most delicious fruit capable of keeping sound for a long time. With this object, the hardy Malinda, the fruits of which have long-keeping qualities, has been crossed with the Wealthy, Rome Beauty, Delicious and other standard apples. There are now more than 10 000 seedling apples on the farm aged between 4 and 7 years thus obtained, and some 500 of them have already commenced to bear and the apples are of good quality.

Thousands of seedlings of the De Soto, Wolf, Aitkin and other native plums have been planted, and out of these, 315 young trees that are superior to their parents in size and productiveness, have been selected. Much

uperior results have been obtained by the crossing of the native varieties vith the large Japan plums, and especially by the cross between the Wolf native) and the Burbank (Japanese). No. 21 is an early seedling that has ttracted considerable attention for its hardiness and earliness; — it egins to bear at the age of two years — as well as for its abundant and egular yield, the size of its fruit, about 1 3/4 inches in diameter, its colour nd the fact that it is a free-stone with a very small pit. The best seedings are being propagated and sent to the trial stations for further testing. They will not be distributed among the public until the list has been narowed down to three or four of the best, of known superiority to any of the varieties now cultivated.

Another important work of selection was the improvement of the Beta grape which is a hybrid of the wild with some unknown standard grape. It is exceedingly vigorous and hardy and resisting to cold, but its fruit is somewhat too acid. Mr. HARALSON has crossed Beta mostly with Concord and Brighton and he has selected 5000 seedlings out of 15 000. At least one-third of the selected vines bears fruit of larger size and better flavour than the Beta and still retains its vigour and hardiness.

From the famous Senator Dunlap strawberry, Mr. HARALSON has virtually evolved a new type, more vigorous than its parent; it bears its fruit on much heavier upright stems and still retains the quality and productiveness of the Senator. Out of 60 000 seedlings he has selected 800.

Five acres of the farm are covered with seedling raspberries. One variety, a cross between the King and London seems to be the most desirable seedling. It has been sent to the trial stations and the reports are uniformly good.

Crossing the Carrie gooseberry, a Lake Minnetonka production, that has proved to be the best gooseberry for Minnesota, with the best American and English varieties, Mr. HARALSON has raised 5000 seedlings, of considerable merit; one-third of these surpasses the parents in size and productiveness.

With the pear, the apricot, and other fruits usually considered too tender to grow in Minnesota, attempts have been made to obtain hardier varieties. Breeding of a hardy pear has encountered many difficulties. Only about two seedlings out of a thousand have been free from blight and most of them suffered from the frost. Nevertheless, the work has been continued, the hardiest commercial varieties being used as parents.

More success has attended the breeding of the apricot. Several hybrids of the Plumcot — a cross between the plum and the apricot — have been crossed with native plums, and the results of this cross have been hybridized again with the apricot and the nectarine. The results have been highly satisfactory. Most of the seedlings have proved perfectly hardy and are bearing fruit of various types, some closely resembling the apricot.

The Minnetonka Lake Station attends also to the improvement of ornamental shrubs. The most important result in this direction has been a hardy purple-leaf plum obtained by hybridizing the hardy native plum and the sand cherry with *Prunus prissiardii*. There are 500 of these

seedlings, seventy-five per cent retaining the striking foliage of their purple-leaved parent and some have proved perfectly hardy and bear choice plums of good quality.

Another handsome plant with ornamental foliage, namely golden yellow streaked with light green, has been obtained by spontaneous bud variation in a hedge of Alpine currant.

Rosa rugosa and *R. arkansana* the native wild rose, have been crossed extensively with the hybrid teas and perpetuals and several valuable hardy roses have been obtained.

The native hazel-nut has been crossed with the filbert with the object of securing the hardiness of the one with the quality of the other.

Most of the hand pollinating is done in the greenhouse. Mr. HARALSON finds that the work can be done there five times as fast as it can in the open. Besides, much of it is accomplished in the winter when the work is not so pressing. The trees and shrubs that are to be treated are transplanted to the greenhouse in the autumn. The seed resulting from the hybridation is carefully planted in the open in the seed beds and the seedlings are transplanted to the fields. All the unsatisfactory specimens are discarded before they reach the fields. The process of grading is continued and as fast as possible the number of seedlings is reduced. As soon as a seedling shows indications of being worthy of introduction it is propagated and specimens are sent to the trial stations. Reports of the behaviour of the seedlings under different conditions are received and tabulated. If they give promise of general value under various environments the testing is continued and when it is certain that a seedling has proved superior to any varieties already introduced it is distributed among the public.

No varieties have been introduced yet, but plans are being made to distribute several in the near future.

1027 – **Inheritance of Certain Characters of Grapes.** — HEDRICK, U. P. (Horticulturist) and ANTHONY, R. D. (Associate Horticulturist, New York Agricultural Experiment Station, Geneva, N. Y.) in *Journal of Agricultural Research*, Vol. III, No. 4, pp. 315-330. Washington, D. C. July 1915.

Breeding experiments with grapes have been carried out during 25 years at the New York Agricultural Experiment Station, but the work was not placed on Mendelian lines until 1905. Since then some 200 varieties have been used including some belonging to *Vitis vinifera* as well as *V. rotuddifolia*.

The usual method of emasculation was found to be ineffective in some cases. Owing to the danger of self-pollination before the calyx cap splits, it is advisable to emasculate the clusters several days before the cap is ready to come off. One of the surprises in the study of grape varieties was the failure of many of the well known commercial sorts to transmit their desirable qualities. Nearly 3000 selfed or pure seedlings were grown and found to be uniformly lacking in vigour.

In studying the inheritance of characters it was found that reflexed stamens are correlated with complete or nearly complete self-sterility and upright stamens with self-fertility. Crosses between varieties with upright

tamens gave offspring with upright and reflexed stamens in the ratio 3 : 1. Thus, selecting from upright varieties will reduce but not eliminate seedlings with reflexed stamens and self-sterility.

Hermaphrodite varieties appear to be homozygous and always breed true. Crosses between hermaphrodite female and pure male gave hermaphrodites and males in equal proportions.

With regard to the inheritance of colour it was found that white is a pure colour and recessive to both black and red. No black variety proved to be pure for blackness. Some contain white and others white and red. Red varieties are similarly heterozygous.

In the breeding for quality of fruit there was a noticeably low percentage of seedlings of good quality. Most grapes of high quality are derived from *V. vinifera* which is probably accounted for by the intense selection to which this species has been subjected for centuries. Pure line seedlings were found to be of lower quality than hybrids.

In the inheritance of size of berry there is no indication of dominance of any one size, though there is a tendency for a variety to produce seedlings approaching its own size.

Out of a vineyard of 1500 seedlings obtained between 1898 and 1903 less than 75 now remain. Of these only 5 have proved sufficiently promising to be named.

CEREAL AND PULSE CROPS

1028 – **New Varieties of Indian Wheats** (1). — HUMPHRIES, A. E., reprinted from *Milling*, June 26, 1915. Liverpool 1915.

The writer made this report on the quality and characteristics of the new varieties of Indian wheat on the suggestion of the Indian Government and for the benefit of the National Association of British and Irish Millers.

Of recent years many new and improved varieties have been placed on the market, and of these " Pusa 12 " and " Pusa 4 " have been thoroughly tested both from the cultivator's and miller's point of view. The writer has tested samples of these varieties grown on widely different soils and under different climatic conditions. Although the appearance of the grain varies with the locality in which it was grown, very little difference is found in their milling and baking qualities. Owing to the limited production of these wheats and their popularity with the natives, there are as yet only small quantities available for European markets. The writer has received a consignment of 30 tons of " Pusa 12 " for distribution so as to enable the millers to make a trial of these new wheats from India. The writer believes these wheats to be a great improvement on the ordinary Indian wheats of commerce and though white in colour they approximate very closely to Manitoba wheats.

In baking these flours the writer found it desirable to use diastatic extracts so as to ensure a sufficiency of gas during all stages of fermentation. Treated in this way these flours will be found to be well worth the attention of millers and bakers.

(1) See also : Qualities desired in Wheat for British Markets and how to ascertain them, by Sir EDWARD BUCK, *B.* June 1915, pp. 773-779. (*Ed.*)

1029 - **Chemical Analyses of Maize and Oats cultivated in the Eastern Republic of Uruguay.** — PRUG Y NATTINO, JUAN in *República Oriental del Uruguay, Ministerio de Industras, Inspección de Ganadería y Agricultura*, Boletin No. 14, 29 pp., 3 Plates. Montevideo, 1915.

Maize. — At the "Vivero Nacional" of Toledo, Eastern Republic of Uruguay, the North American "Gold Dent" variety of maize was crossed with the "amarillo común" (common yellow also known as the "Crystal" or "Flint" variety). From the offspring of the cross were chosen, on the one hand, the ears carrying "Gold Dent" characters, and on the other, those possessing the characters of "amarillo comùn". The "Gold Dent" type is apparently not accepted on the market, the "common yellow" and "quarantino" maizes being preferred, perhaps because they are less liable to insect attack. In any case, these varieties have the great disadvantages of producing small crops (no doubt on account of careless seed selection) and bearing large ears with small grain. Accordingly, M. Sapriza Vera, the Director of the "Vivero" at Toledo, carried out the above-mentioned cross, subsequently exercising selection, in order later to combine and fix the qualities of the common yellow maize (hardness of seed coat, resistance to damp and to insects, a horny appearance) with those of the "Gold Dent" variety (thickness of grain, thinness of rachis, large yield). Positive results have already begun to be obtained.

The writer has tabulated the results of the analyses of samples of the 1913-1914 crop obtained at the "Vivero" at Toledo and the Sayago Experiment Station with maize of different strains. The maximum and minimum values obtained with 45 samples are given in Table I.

TABLE I. — *Analyses of Maize Grown in the Eastern Republic of Uruguay.*

	Maximum per cent	Minimum per cent
Water	22.20	14.46
Dry matter	85.44	77.80
Organic matter	84.537	76.210
Ash	2.496	0.987
Fatty matter	5.221	0.251
Fibre	2.573	0.800
Nitrogen	1.970	1.260
Protein (N. × 6.25)	12.310	7.875
N- free extract	69.103	63.005
Phosphates (P_2O_5 of the ash)	0.932	0.200
Lime (CaO of the ash)	0.190	0.011
Acidity (in acetic acid)	0.60	0.008
Starch equivalent	75.79	65.82

Oats. — In 1913, oats occupied, in the Eastern Republic of Uruguay, an area of 50 438 acres producing 126 561 tons of grain; in 1914 they covered 97 445 acres with a yield of 165 867 tons of grain. Oats have also considerable importance as a forage crop, especially in regions where it is impossible to grow lucerne. The unit production (in grain) is generally

ow, owing to the wide area over which they are cultivated. On the other and, the composition of the oats is good and their starch equivalent excellent, witness the analyses quoted by the writer of seed samples from the Experiment Station and the Montevideo Chamber of Commerce.

TABLE II. — *Analyses of Oats Grown in the Eastern Republic of Uruguay.*

	Crude matter			Digestible nutrients (minus amides)		
	Minimum %	Maximum %	Average %	Minimum %	Maximum %	Average %
Raw Protein	9.81	14.00	11.905	5.61	8.00	6.805
Fatty matter	4.92	6.95	5.985	3.94	5.56	4.750
N- free extract	55.12	60.98	58.050	41.89	46.34	44.110
Crude Fibre	8.86	15.34	12.105	2.48	4.30	3.390
Ash	3.12	4.26	3.690	—	—	—
Phosphates (P_2O_5)	0.347	0.58	0.463	—	—	—
Lime (CaO)	0.084	0.14	0.112	—	—	—
Yield	—	—	95	—	—	—
Digestible albumen	—	—	—	5.97	8.51	7.240
Starch-value per cent	—	—	—	58.77	62.26	60.515

1030 – **Grades for Commercial Corn (Maize).** DUVEL, J. W. T. (Crop Technologist in Charge of Grain Standardization Investigations) in *Bulletin of the U. S. Department of Agriculture*, No. 168, 11 pp., 9 figs, 1 coloured plate. Washington, July 15, 1915.

By virtue of the authority vested in the Secretary of Agriculture by the Acts of Congress of June 30, 1906 (34 Stat., 669) and of March 4, 1913 (37 Stat., 828), to fix definite grades of grain, the grades for corn shown in Table I were fixed and promulgated on January 3, 1914, to take effect on July 1, 1914.

GENERAL RULES.

(1) The corn in grades No. 1 to No. 5, inclusive, must be sweet.

(2) White corn, all grades, shall be at least 98 per cent white.

(3) Yellow corn, all grades, shall be at least 95 per cent yellow.

(4) Mixed corn, all grades, shall include corn of various colors not coming within the limits for color as provided for under white or yellow corn.

(5) In addition to the various limits indicated, No. 6 corn may be musty, sour, and may also include that of inferior quality, such as immature and badly blistered corn.

TABLE I. — *Grade classification of white, yellow, and mixed corn, showing maximum allowances of moisture and other factors.*

Grade classification	Maximum allowances of —			
	Moisture	Damaged corn	Foreign material, including dirt, cob, other grains, finely broken corn, etc.	"Cracked" corn, not including finely broken corn. (See general rule No. 9.)
	Per cent.		Per cent.	Per cent.
No. 1	14.0	2 per cent (exclusive of heat-damaged or mahogany kernels)	1	2
2	15.5	4 per cent (exclusive of heat-damaged or mahogany kernels)	1	3
3	17.5	6 per cent (exclusive of heat-damaged or mahogany kernels)	2	4
4	19.5	8 per cent (may include heat-damaged or mahogany kernels not to exceed one-half of 1 per cent)	2	4
5	21.5	10 per cent (may include heat-damaged or mahogany kernels not to exceed 1 per cent)	3	5
6	23.0	15 per cent (may include heat-damaged or mahogany kernels not to exceed 3 per cent)	5	7
Sample	—	See general rule No. 6 for sample grade	—	—

(6) All corn that does not meet the requirements of either of the six numerical grades by reason of an excessive percentage of moisture, damaged kernels, foreign matter, or "cracked" corn, or corn that is hot, heat damaged, fire burnt, infested with live weevils, or otherwise of distinctly low quality shall be classed as sample grade.

(7) In No. 6 and sample grades, the reasons for so grading shall be stated on the inspector's certificate.

(8) Finely broken corn shall include all broken particles of corn that will pass through a metal sieve perforated with round holes nine sixty-fourths of an inch in diameter.

(9) "Cracked" corn shall include all coarsely broken pieces of kernels that will pass through a metal sieve perforated with round holes one-quarter of an inch in diameter, except that the finely broken corn, as provided for under rule No. 8, shall not be considered as "cracked" corn.

(10) It is understood that the damaged corn, the foreign material (including dirt, pieces of cob, finely broken corn, other grains, etc.), and the coarsely broken or "cracked" corn, as provided for under the various grades, shall be such as occur naturally in corn when handled under good commercial conditions.

(11) Moisture percentages, as provided for in these grade specifications, all conform to results obtained by the standard method and tester scribed in Circular Nº 72, Bureau of Plant Industry, U. S. Department Agriculture.

31 – **The Best Kinds and Varieties of Cereals and Roots for Eastern Canada (Province of Quebec) as Determined by Experiments Conducted at Macdonald College.** — *Ministère de l'Agriculture de la Province de Quebec, Bulletin*, No. 8, 11 pp. 1914.

omparative yields of the principal cereals obtained during five years' experiments conducted at the Macdonald College, Province of Quebec, Canada.

	lbs. per acre
Six-rowed barley	2744
Two-rowed barley	2257
Emmer	2225
Oats	2169
Peas	2047
Spelt	1790
Milling Spring Wheat	1783
Durum wheat	1776

	Minots (1) per acre
ts:	
Early oats Dauberney	69.42
» » Alaska	65.74
Semi-early oats: Banner (Dery)	69.36
» » Fifth Pound Black (4 years)	47.46
rley:	
Mensury (six-rowed)	59.50
Manchuria (six-rowed)	55.55
Canadian two-rowed	49.25
Duck bill (Guerin) (two rowed)	48.37
N. Z. Chevalier (two rowed)	45.57
Guy Mayle (naked barley) (55 lbs. per bushel)	45.76
Success (beardless)	44.07
ing wheat:	
Pringle's Champion	32.44
Red Fife	32.34
White Russia	31.20
s:	
Prussian Blue	37.18
Golden Stem	34.72
English Gray	34.63
:	
Spring: common	30.10
» Saatroggen	26.52
Autumn: Cochrane (2 years)	44.01

1) Minot = 1.074 bushels.

The best ensilage maize for the province of Quebec.

	Tons per acre 4 years' average
Dent :	
Early Leaming	15.270
Howie	15.020
White Cap Yellow Dent	13.756
Flint :	
Longfellow	15.474
North Dakota	15.468
Red Philip	15.910

The best maize for green fodder.

Duke's Improved Sweet	17.907
Mastodon (Dent)	18.916
Sanford (Flint)	16.729

The best maize for grain.

Yellow Quebec (Flint).

Influence of the date of sowing upon yield.

	Wheat	Barley	Oats	Prussian Blue peas	Common Emmer	Red spelt
	Minots per acre				Lbs. per acre	
1st sowing	38.12	65.52	76.28	51.61	3 433	3 166
2nd »	29.69	64.51	67.46	52.03	3 091	2 758
3rd »	29.58	60.47	67.92	54.90	2 783	2.533
4th » (4 years).	25.93	58 39	65.07	50.98	2 733	1 800
5th »	19.63	61.75	61.05	43.18	2 600	1 341
6th » (3 years).	18.95	64.19	59.97	39.37	2 317	1 075

Most productive beets, Siamese cabbage, turnips and carrots.
Three years' averages.

	Tons per acre	Nutritive value
Beets :		
Intermediate Yellow Giant	35.78	100
Sugar beet	40.33	95
Red Mammoth Perfection	37.94	86
Primée Yellow Globe	39.02	82
Siamese Cabbage:		
Hall's Westbury	25.71	100
Kangaroo	24.34	103
Queen	27.88	100
Turnips:		
White Globe	28.29	100
Imperial Green Globe	30.82	103
Long Keeper Aberdeen	23.34	100
Carrots:		
Champion Intermediate	28.23	100
Yellow Intermediate	20.78	88
Magnum Bonum	18.45	80

2 - **Experiments in Germany on the Selection of Seed Potatoes** (1). — CLAUSEN, in *Journal fur Landwirtschaft*, Vol. 63, No. 1, pp. 1-32. Berlin, April 27, 1915. STARCH CROPS

The following points were studied experimentally:

1) The influence of the size of the tuber upon the yield.

2) The comparative yields of 1 gr. of seed potato substance in tubers lifferent weights.

3) The influence of the size of the tubers upon the number of po- oes harvested.

4) Whether the size of the tuber has an influence upon the aver- weight of the tubers of the crop.

5) The yield of the tubers in proportion to that of their parents, or other words, how far the effect of heredity is observable in the crop of ers.

6) Whether the number of tubers and the weight of the tubers hereditary characters in the potato.

7) The result obtained by planting two tubers in the same hole.

For his experiments, which extended from 1908 to 1913, the writer d 3 varieties of potato "Sechswochenkartoffel", "Eierkartoffel" and p to Date" which were planted according to the usual method.

For comparison, tubers taken from plants of the same pedigree were used.

The results of the experiments may be summarised as follows:

1) With the increase in the size of the tuber the crop increases more n is generally supposed. The greater cost due to using larger tubers is ter repaid by early than by late varieties. When the tubers regularly used planting are larger than the average potatoes harvested, the advantage electing the seed tubers is much less than when the tubers planted are ller than the average potatoes of the crop. The advantage of a large potato is greater in soil that is little, or not at all, manured, than in case of well manured soil.

2) The larger the seed potato the smaller the yield in proportion to . of seed potato substance. If, therefore, it is necessary to economise and the farmer has sufficient land at his disposal, small tubers may planted with advantage.

3) The greater the weight of the tuber planted, the larger is the mber of tubers on the plant produced.

4) A large seed tuber usually produces small tubers and *vice-versa*

5) A tuber from a plant of large yield generally gives rise in its to a highly productive plant. Tuber yield is therefore a hereditary racter.

6) The number of tubers is a hereditary character, but one which is observed on comparing, from the point of view of their yield, parent nts derived from tubers of the *same weight*. The size or weight of the ers is not a hereditary character, and consequently it is not possible to ain heavier tubers by selection.

7) By planting 2 tubers in the same hole, no larger yield is obtained n if only one is planted.

(*Ed*).

(1) See also *B.* Aug. 1915, No. 803.

FORAGE CROPS. MEADOWS AND PASTURES

1033 - **Experiments with Lucerne in Victoria, Australia.** — RICHARDSON, A. E. (Agricultural Superintendent) Results of Lucerne Tests, Season 1914-15, in *The Journ of the Department of Agriculture of Victoria, Australia*, Vol XIII, Part 7, pp. 417-436. M bourne, N. S. W., July 1915.

The above experiments, which were conducted at the Central Researc Farm Werribee, Victoria, fall under two headings:

(1) Water Requirements.

(2) Fertiliser and Cultural Requirements.

I. *Water Requirements.* — To determine the water requirements lucerne, 4 pots, each containing 280 lbs. of moist soil, were used. Tw of these were kept as controls under bare fallows and two were sown wit Hunter River lucerne. The plots were weighed weekly throughout the yea on a specially constructed steelyard turning to less than $^1/_{10}$th of a poun The whole series of plots was brought to constant weight once weekly b the addition of water lost during the preceding week; the moisture conte being kept fairly constant in this way, the rate of evaporation was als uniform. The gravel mulch was further kept well stirred in order to redu water losses to a minimum.

As each crop of lucerne matured it was carefully harvested and th dry matter in each cut determined in the laboratory.

The results obtained are represented graphically by plotting th periods of growth as ordinates and the water requirements as abscissa The resultant graphs show the following:

(1) Transpiration from a lucerne crop during its 2nd year of growt

(2) Evaporation from a bare fallow,

(3) do » » free water surface (Evaporometer),

(4) Transpiration and evaporation from a lucerne crop during it 2nd year of growth.

After each cut the curve of transpiration flattens, representing dim nished water requirements of the young lucerne. As the lucerne develop the curve of transpiration becomes progressively steeper, reaching a max mum immediately before cutting. The curve representing the evapora tion from a free water surface may be interpreted to show that an acr of lucerne in full growth will evaporate more water through its leaves tha would be evaporated in a year from an acre of standing water.

Seven cuts were made during the year and these required 54 inche of water per acre. During the same period, the soil, though well mulched lost 10 inches by evaporation, thus bringing the total loss from cro and soil to 64 inches. Seeing that the amount of dry matter produce throughout the year was 8 tons per acre the amount of water require to produce 1 ton of dry matter was 8 inches. Subtracting the 1 $^1/_4$ in ches lost by evaporation from the soil it may be said that, roughly, to pro duce 1 ton of lucerne about 7 inches of water must actually pass throug the growing crop. This brings in view a limiting factor for the productio of heavy lucerne crops in certain districts. With a rainfall of say 21 inche it is possible to calculate the maximum possible production of lucerne. - Assuming 33 per cent. of the rainfall to be a fair estimate of the direc

s by evaporation, then 2 tons per acre would represent the maximum pro-ction possible in these circumstances, provided, of course, the lucerne not draw on subterranean sources of moisture. Similarly, to produce rop of 5 tons to the acre in a district with a rainfall of 21 inches it would necessary to apply some 31 ½ inches of irrigation water.

Tests of water requirements made in the field showed close agree-nt with the results of the pot tests.

The amount of fertilising substances in the soil also exercises an in-ence on the water requirements of a crop, in particular, the presence of ufficiency of soluble phosphates helps to reduce the transpiration ratio.

II. *Fertiliser and Cultural Requirements.* — The heaviest seedings lucerne gave the best results, but there appears to be no material benefit sowing more than 18 lbs. of seed per acre. As regards the application fertilisers, nitrogenous manures, though not generally used for legumi-us crops, gave the most marked increases. Superphosphate proved to the most efficient of the artificial phosphates and, on certain soils, dress-gs of lime, applied every two years at the rate of 10-12 cwt. per acre, of ground limestone at the rate of 20-25 cwt., are likely to prove profit-le.

In localities where lucerne has not previously been grown, inocula-n with soil from an old lucerne field is recommended. Only small por-n of the land need be so treated, the remainder soon becoming inocu-ed through the moving of stock and implements and through the agency irrigation water.

34 – **Cultivation for Strengthening a Lucerne Field.** — LONSDALE, T. W., in *The Journal of Agriculture*, Vol. X, No. 5, pp. 413-414, 3 Figs. Wellington, May 20, 1915.

It is generally maintained that a lucerne field should not be inter-ed with once it is well-established. Experiments at the Moumahaki perimental Farm, however, show that measures adopted for the destruc-n of weeds have the further advantage of making the growth of the plants re bushy.

A lucerne field at this station was badly infested with weeds and as an eriment in weeding it was divided into six plots: one was cultivated to epth of 6 inches, a second skim-ploughed, the third was bastard plough-i. e. furrow only partially turned over by setting the plough to take too ge a furrow, the fourth was disc ploughed, the fifth was worked with a spring-ed cultivator and the sixth was used as a control. The work was carried in May 1914 (Autumn) and the following year two crops were taken. May 1915 the general development of the lucerne was excellent and the wth more vigorous and free from weeds in proportion to the thoroughness the previous cultivation. Where the plants were actually ploughed, y showed a much greater development. The pieces of old roots cut in the furrows gave rise to young vigorous shoots. The other treatments e equally satisfactory results, but not so good as with the more drastic tment. This means of cultivation is therefore a very simple and ctive means of destroying weeds in lucerne crops.

1035 – **A Stoloniferous Red Clover,** in *The Journal of Agriculture*, Vol. X, No. 5, p. 41 Wellington, May 20, 1915.

The plant breeding section of the Moumahaki Experiment Stati has succeeding in obtaining a stoloniferous *Trifolium pratense*, that is say, a variety which is propagated by underground stolons and whi is therefore of great value for light sandy soils. It was obtained from plant found in Auckland by J. Beveridge, the assistant plant-breedi officer of the Station. Seeds of this plant have been sown to test t inheritance of this character.

1036 – **Experiments on the Cultivation of *Phalaris bulbosa* as a Forage Pla at the Glen Innes Experiment Station, New South Wales.** — BREAKWELL, E., in *T Agricultural Gazette of New South Wales*, Vol. XXVI, Part. 6, pp. 487-488. Sydn June 2, 1915.

Phalaris bulbosa has given excellent results for four years at the Gl Innes Experiment Station. It tillers abundantly, has large, tender, succule leaves very agreable to live stock, is resistant to winter cold, remains gre under conditions of moderate drought and in a severe drought its roo retain their vitality and produce fresh shoots after humid conditions a restored.

The plant shows considerable variability. At the Bathurst Expe ment Station it has been found that plants from imported seed are mu inferior in growth and resistance to drought than those of the select strains at this Station, which attain a height of 4 to 5 feet.

FIBRE CROPS

1037 – **Industrial Fibre Plants of the Philippines.** — MULLER, THEODORE in *Jour of The New York Botanical Garden*, Vol. XVI, No. 184, pp. 69-79, 2 plates. L caster, Pa, April 1915.

This article briefly describes the important fibre-plants of the Phili pine Islands and illustrates their mode of preparation and use.

The descriptions may be summarised as follows :

Plant	Preparation	Uses
Corypha elata (Buri or Talipot palm)	Young unopened leaves dried in the sun and cut into strips.	The manufacture of sugar b and coarse mats.
	Bleached by boiling in vinegar.	The bleached fibres are u for hats, baskets, handb and tobacco cases. epidermis of the unoper leaflets is known as "rafi which is woven into cl for cushions and screens.
	Midribs are bleached and spliced.	Used for hats.

Plant	Preparation	Uses
enga mindorensis and *A. sac-charifera* (sugar palm)	Petioles of different ages yield splints of different colours.	Excellent for basketry. Sugar palm furnishes rope highly resistant to salt water. The fibres round the trunk are used as bristles for brushes.
cos nucifera (Coconut)	—	Leaves for thatching. Coir from the nuts for door mats. Midribs for chairs and tables. Stele of young roots for baskets.
ipa fruticans (Nipa palm)	—	Leaves for thatching. Manufacture of alcohol.
lamus mollis (rattan)	—	Fine splints woven into hats. Canes for chairs.
Screw Pines : *ndanus tectorius*	—	Epidermis of leaf used in Japan for "panama" hats.
sabotan or *P. tectorius* var. *sinensis*	Removal of spines and bleaching.	For hats and mats of high quality.
utilissimus	Leaves rolled under heavy logs.	Strips used for mats and telescope baskets.
simplex		
Grasses : *mbusa blumeana*	Old stems.	Water pipes, kitchen utensils.
	Middle internodes of young stems 4 to 5 months old. After wilting for 24 hours the stem is divided into 3 or 4 parts and flattened. Only the inner layers are used. Boiled in water for half an hour and sun bleached.	Manufacture of hats.
dropogon zizanioides	—	Fragrant roots used as perfumes. Occasionally fans are made from the roots and hats from the flower stalks.
var. *genuina*		
var. *nigritanus*		
ragmites vulgaris	—	Panicles used for brooms
ysanolaena maxima	—	For the best brooms.
xlachryma-jobi (Job's tears)	—	Hard shelled seeds used for rosaries, curtains, baskets and trays.
perata cylindrica var. *koe-igii*	—	As thatches by the poor.
exaltata	—	Flower stalks occasionally for hats.
haemum angustifolium	—	Excellent for slippers.

Plant	Preparation	Uses
Sedges :		
Fimbristylis utilis *F. diphylla*	Inflorescence removed and the sedge is dried and made pliable hy hand.	Sleeping mats and hats.
Cyperus malaccensis	—	Manufacture of slippers.
Vines :		
Epiprennum elmerianum *Raphidophora copelandii* *R. merrillii*	Removal of epidermis and cortex from aerial roots.	Central cylinder used for ba ketry.
Pericampylus incanus	Leaves removed, stems boiled in water for two hours to facilitate removal of epidermis and cortex.	Basketry.
Entada scadens	—	Substitute for soap.
Leaf fibres :		
Musa textilis (abaca)	Pulling the petioles of the leaves under a dull knife.	Manila hemp, the staple fib of the Islands. Epidermal strips used for mal ing coiled baskets.
Musa paradisiaca	Similar to the above.	Coarse fabric.
Ananas sp, (pine apple)	Leaves scraped with a blunt piece of pottery, bamboo or iron.	For the finest cloth.
Agave cantula (Sisal)	Retting.	Sisal hemp.
Sanseviera zeylanica	—	Bowstring hemp.
Miscellaneous :		
Ceiba pentandra (kapok)	—	Kapok as filling material
Dendrobium crumenatum	Stalks boiled in water or vinegar or bleached in the sun.	Decorative fibre in basketry.
Donax cannaeformis	—	Splints for basketry.
Tilia spp. *Malva* spp. *Sterculia* spp.	—	Bast fibres used for rope.

1038 – **The Raffias of French Equatorial Africa** (1). — Report of M. F. ROUGET, Delega of the General Government of French Equatorial Africa to the Colonial Office, in *Bulle de l'Office Colonial*, Year 8, No. 90, pp. 273-294. Melun, June 1915.

This report takes the form of an interesting monograph on raffia an deals with its uses in Europe, its trade and production and, finally, the futu of its production in French Equatorial Africa.

(1) See *B.* January, No. 108.

I. *Utilisation of raffia.* — ROUGET refers the reader to the works of DESANDES and E. BECCARI for detailed information regarding the botany, cultivation and uses of the palms of the genus *Raphia*. He emphasises its general employment in horticulture and especially in viticulture for tying up vines, and refers to the semi-impermeable materials, known as *rabanes*, used by the Betsimasaraka women in the making of garments. A manufacturer of Lyons, M. Roche, has obtained from it light and very original materials which would have a ready sale in Europe. But in order to weave these stuffs he regards the following conditions as necessary:

1) Very regularly wound, firmly attached threads of an absolutely uniform colour.

2) Bundles of threads folded with extreme regularity.

3) Prohibition of the winding of the fibre in the form of balls or on pieces of wood, and also of the practice of winding too much fibre on the same board.

The raffia should be forwarded in the form of skeins not exceeding 1 $^{3}/_{4}$ oz in weight and costing 8 $^{3}/_{4}$ *d.* per lb. This price, however, is too low, on account of the expenses of transport.

II. *Countries importing raffia.* — This substance is now chiefly used for agricultural purposes, the vine-growing countries especially buying it in large quantities.

France imported 9 735 763 lbs. in 1912 and 7 841 040 lbs. in 1913, *i. e.* 50 per cent of the total export. Germany took 5 060 000 lbs. in 1912 and 4 013 354 lbs. in 1913.

England imported 342 349 lbs. in 1910 and 727 430 lbs. in 1913. Hungary purchased 4 974 420 lbs. in 1910 valued at about £ 48 000. Amongst other importing countries may be mentioned, the United States, which receive raffia from Hamburg and Havre, as well as direct imports from Madagascar, estimated at 39 600 lbs. in 1912 and at 154 000 lbs. in 1913. Belgium imported about 33 000 lbs. in 1913 ; Austria, Bulgaria, Bosnia-Herzegovina, Rumania, Russia, Greece, Spain and India obtain their necessary supplies from the ports of Hamburg, Trieste and Marseilles, the required amounts being obtained from the consignments for France, Germany and Hungary.

III. *Raffia-producing countries.* — Madagascar, and the provinces of Majunga, Nossi Bé, Ananalava in particular, and the East Coast of Africa supply nearly all the raffia used in Europe. The Madagascan Chamber of Commerce has obtained a Decree, dated July 1, 1904, regulating the trade in this substance, in such a manner as to prevent the sale of faked or badly prepared fibre, and has thus succeeded in making Madagascar the chief centre of the production of this fibre.

However, French Equatorial Africa and the Middle Congo can also produce considerable quantities, the samples of which in the past were generally deficient in length and colour, but the product has appeared to be of interest at different times.

IV. *The future of the raffias of Equatorial Africa.* — In order to organise the exploitation of the raffia of Equatorial Africa and the forwarding of

the fibre to Europe, the workers, of whom there is a large supply, shoul be properly trained. The fibre must be scrupulously clean and supplie in nice twists or plaits. The raffia should be white, the leaves broad, fre from curl and of good length. The bales made by the hydraulic pres weigh about 220 lbs. net, they are covered with a matting of palm leave and usually encircled by iron hoops.

The price for average fibre remains more or less stationary between 22 and 24 *s* per cwt. These prices are the very lowest possible on accoun of the enormous amount of work entailed in the production of raffia and th labour and expense necessary for its transport to the consumer. On th other hand, the demand for the fibre, under present conditions, ofte scarcely keeps pace with the production.

At the same time, as the quality of the raffias of Equatorial Afric has appeared satisfactory to certain brokers, it should be possible by deli vering the produce regularly and in good condition to insure to them place very near the Madagascan products.

1039 – **Morphology of the Madagascan Varietes of the Genus *Crotalaria*.** — LA COSTE, A., in *Revue Générale de Botanique*, Vol. 27, No. 313, pp. 10-21. Paris, January 15 1915.

After a summary of the facts relating to the morphological positio of the genus an anatomical description is given of the stem, petiole, lamin and fruit of the different species furnishing *Crotalaria* fibre. The articl concludes with a key for the identification of the different Madagascan spe cies by means of their anatomical characters.

CROPS YIELDING OILS, DYES AND TANN INS

1040 – **Mangrove Cutch in the Federated Malay States.** — BARNARD B. H. F. (Acting Con servator of Forests F. M. S. and S. S.) in *The Agricultural Bulletin of the Federated Mala States*, Vol III, Nos. 6-7. pp. 241-245. Kuala Lumpur. March-April 1915.

The mangrove forests on the coasts of the States of Perak and Selan gor cover an area of about 250 square miles. The composition of thes forests varies according to the nature of the soil and to the extent to whic it is liable to inundation by the tides. The principal species occurring ar *Rhizophora mucronata, R. conjugata, Avicennia officinalis, Bruguiera gym norrhiza, B. caryophylloides, B. parviflora, Ceriops candolleana, Carapa mo luccensis and Sonneratia apetala.* Of these the first seven are known to con tain tannin in varying quantities varying from 42.6 per cent. in the case o *Ceriops* to 10.4 per cent. in *Rhizophora conjugata.*

Cutch is manufactured in the Malay Peninsula only in small quantitie and for local use, the bark of *Ceriops candolleana* being preferred. Thi species, however, is not available in large quantities, the most abundan species being *Rhizophora mucronata* and *R. conjugata.*

The forests are worked on a regular system for firewood which is of ex cellent quality and used on the local railways and for domestic purposes Under present conditions the bark from this wood is entirely a waste product The average output of firewood during the last three years was 128 00 tons. Transport in the mangrove forests is exceptionally easy, the whol forest being intersected by creek and water ways, the smallest of which i

ays navigable by small boats at high tide. The health of the labour e also presents no difficulty since malaria is less in evidence than in in- l districts and the wood cutters and fishermen inhabiting these villages exceptionally healthy.

In leasing the forest areas for firewood cutting the Government imposes ain restrictions so as to ensure the restocking of the forest. The areas ed for this purpose contain the species most valued for tannin though no e *Avicennia officinalis* forest is included. In case, however, of t e develop- nt of the cutch industry arrangements can be made also for the working hese forests.

RUBBER, GUM AND RESIN PLANTS

1 – **Variation in Plantation Rubber Caused by Lack of Uniformity in Factory Methods.** — EATON B. J. and GRANTHAM, J. in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, Nos. 6-7, pp. 218-225. Kuala Lumpur, F. M. S., March-April 1915.

These experiments were made in the course of a search for the factor or tors responsible for variability in plantation rubber. Series of samples rubber were subjected to different treatments during preparation and ir comparative values were determined after vulcanisation in terms of rate of cure, breaking strain and elongation.

The various treatments investigated were :

1. creping and maceration ;
2. excess of acid in coagulation ;
3. sodium bisulphite in coagulation.

The results of these investigations showed that :

1. the effect of creping on rubber both as regards optimum chanical properties and rate of cure is negligible unless the treatment is essive.

The slight effect on the rate of cure is probably due to the removal by shing of traces of a catalytic substance or something necessary to its for- tion ;

2. the effect of using excess of acetic acid for coagulation of the latex a well marked effect in retarding the rate of cure, though the mechanical perties are not affected ;

3. the effect of bisulphite on crepe rubbers is nil, though in the case sheet rubber where the bisulphite is not complety removed there is son to believe that its use is injurious.

Other methods of treatment are also being investigated from the ne point of view.

SUGAR CROPS.

2 – **Studies in Indian Sugar Canes : No. 1. — Punjab Canes** (1). — BARBER, C. A. (Government Sugar Cane Expert, Madras) in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 1, pp. 1-106, Plates I-XIX. Pusa, May, 1915.

The studies are confined for the present to the canes of the Punjab ar-cane tract at the north western end of the submontane area of North lia extending from Assam and Bihar to Kashmir. In this tract large ses of canes are either ruled out by inclemency of climate or repre-

(1) See *B.* April 1915 N° 380, and *B.* Sept. 1915, N° 919. (*Ed.*)

sented by solitary examples, the shortness of the period of growth and the incidence of frost being limiting factors. Thus, this area contains the smallest and hardiest canes in India, with strong resemblances to the wild grasses of the genus *Saccharum* in the same region. The study of these canes is therefore of interest in solving the problem of the origin of the sugar-cane, at present found wild in no part of the world.

The two chief canes of the Gurdaspur District known as *Katha* and *Dhaulu* resemble most closely the wild forms of *Saccharum spontaneum* in their general trend of morphological characters.

S. spontaneum responds very readily to cultivation and sometimes shows variations which take after one and sometimes after the other of these two cultivated varieties which in themselves are remarkably constant. This is probably due to the propagation of the former by seed. The two cultivated forms are found to be perfectly sterile *inter se* but numerous crosses have been obtained with the wild forms. Among the seedlings of indigenous canes there are occasional forms showing remarkable similarity to *Saccharum spontaneum*.

A full study of the relationship of the Punjab canes to those of other parts of India has not yet been made, but the two varieties *Dhaulu* and *Katha* are connected with two series of canes gradually becoming thicker and more divergent as we arrive at better cane-growing conditions towards the south-east.

From the Dhaulu cane the writer traces a series of canes ending in the Mango group of short thick canes typical of Bihar, from which it is probable that some of the thicker cultivated forms of the tropics have originated.

In contrast with this hypothesis of the origin of the sugar-cane in parts least suited to its growth is the idea in vogue that the cultivated cane originated at the head of the Bay of Bengal, Cochin China or in the Malay Archipelago. In order to determine between the two hypotheses as to whether the Punjab canes are direct descendants of *S. spontanea* and have given rise to the better canes of India, and that they are degenerate members of groups evolved elsewhere, more information on canes over larger areas is required.

The description of the various canes examined concern only their morphological character as it has not yet been possible to deal with other characters of importance in the field and mills. Accurate figures for tillering, hardness of rind and its detachability, quantity of fibre and other milling characters require careful study by officers constantly on the spot and in charge of milling operations.

The list of characters dealt with is as follows :

1. *General remarks on distribution, agricultural and chemical characters.*
2. *Cane measurements.*

Dead leaves at six months old.
Length of cane and of shoot after stripping.
Total length of cane and number of joints at six and ten months
Total length divided by average thickness at middle.

Length of joints in different parts of the cane
Thickness of the cane at various points.

3. *Colour of cane.*
   General
   Bloom
   Growth ring
   Root zone
   Blackening
   Blushing.
   Scar line or band
   Ivory markings, splitting
   Groove markings within the leaf sheath.

4. *Characters of the joint.*
   Thickness, ovalness in section
   Length of mature joint (deducting top) average longest, average shortest (basal)
   Shape viewed medially
   Shape viewed laterally
   Leaf scar and its ending, lip.
   Circlet of hairs
   Groove
   Root zone
   Growth ring.

5. *Bud.*
   Shooting, bursting, etc.
   Size and form
   Origin and cushion
   Flanges.
   Bristles, basal patches and minute black hairs.

6. *Leafy shoot.*
   Colour
   Terminal tuft of leaves
   Character of leaf ends
   Number of terminal joints under 2 inches long.

7. *Leaf sheath.*
   Length, average longest
   Colouring bloom, scarious border and edges.
   Hairs on back and edges
   Clasping stem
   Proportional width of sheath and lamina
   Ligular processes
   Ligule and hairs on its edge.

8. *Lamina.*
   Width and length, average extremes and proportion of these to one another
   Channelling
   Transverse marks
   Serrature
   Proportional width of midrib to lamina.

The number of canes necessary for a proper average of each quantitative character has not as yet been determined. Six are certainly insuf-

ficient and it is hoped that 20 will prove ample as the labour required is excessive.

Five classes of cane in the Punjab district are described in terms of the above characters, the text being illustrated by 19 plates.

1043 - **Conservation of Soil Moisture in Sugar Cane Plantations.**— TRAWLEY, J. T. and CADY, W. B., *Government of Porto Rico, Board of Commissioners of Agriculture*, Bulletin No. 8, pp. 7-9. Rio Piedras, P. R., 1915.

The rainfall of Porto Rico is sufficient for the cultivation of sugar cane, but its distribution during the year is sometimes unfavourable. Methods for the conservation of soil moisture are therefore very useful. The two practicable methods for this purpose are frequent weeding and mulching with cane trash.

An experiment was carried out with three plots : one fallow, another mulched with a six-inch layer of cane trash and the third hoed to a depth of two or three inches once a week to represent shallow cultivation. At the end of the period September 8, 1914 to June 1, 1915 the percentages of humidity in the first 12 inches of soil were as follows :

Plots	Humidity
1.	27.8
2.	31.9
3.	29.7

It is therefore evident that mulching is the most advantageous process, especially where the soil has not been hoed. It should be noted that the surplus in favour of mulching represents moisture which is all available to the plants.

1044 - **The Foliage of Beets in Relation to their Sugar Content.** — MALPEAUX, L., in *La Vie agricole et rurale*, Year 8, No. 12, pp. 113-216. Paris, August 14, 1915.

The writer's researches have as their object the study of the relations existing between the amount of the foliage of the beets, its colour at the time of pulling and the quality of the roots.

The first part of the work consisted of a comparison between early and late-sown beets.

Those sown early possess more leaves at the end of October than the late-sown plants, and also have a higher sugar content. But this relationship assumes a more general character if the comparison is made for a particular group amongst lots which have a varying and increasing amount of foliage. Those beets with the largest proportion of leaves to roots are generally the richest in sugar. The figures obtained by the writer and given in Table I demonstrate these relations, and show, although no claim is made to a strict relationship, that the highest leaf percentages correspond to the best roots. In this table the maximum sugar content corresponds to 100 parts by weight of leaves to 100 parts by weight of roots.

This relation between the number of leaves and the amount of sugar is proved to be fairly constant on comparing, as in Table II, the different varieties.

TABLE I. — *Proportion of leaves and quality of roots.*

Lots	Average weight		Leaves per 100 parts of roots	Sap density	Sugar per 100 parts of sap	Purity	Amount of sugar per 100 parts of beets
	Roots gr.	Leaves gr.					
No. 1	650	450	70	7.2	16.34	86.3	14.19
» 2	850	520	73	7.4	16.86	86.7	14.61
» 3	830	650	78	8.1	18.17	85.4	15.65
» 4	730	625	84	8.0	18.15	86.3	15.64
» 5	610	540	88	7.8	17.83	87.0	15.39
» 6	590	540	91	8.0	18.46	86.8	15.86
» 7	620	580	94	8.3	18.52	85.0	15.97
» 8	670	670	100	8.5	18.99	85.0	16.29
» 9	630	670	106	8.4	18.78	85.0	16.11
» 10	720	830	115	8.2	18.58	86.2	15.98

TABLE II. — *Amount of foliage and quality of roots in the different varieties.*

	Average weight		Leaves per 100 parts of roots	Density of sap	Sugar per 100 parts sap	Purity	Sugar per 100 parts of roots
	Roots gr.	Leaves gr.					
Mammoth Disette	1 150	390	34	4.4	8.03	66.1	7.16
Blanche demi-sucrière . .	950	360	38	4.6	8.80	69.5	7.83
Eckendorf.	900	350	39	4.4	8.15	67.2	7.26
Yellow globe	950	370	40	5.2	8.15	67.2	8.20
Disette rose	800	350	44	5.6	10.00	65.5	8.82
Rose demi-sucrière . . .	800	370	46	5.3	10.12	70.0	8.94
de Bessey Oval	630	400	63	5.2	9.41	66.2	8.32
des Barres Oval	900	570	63	5.1	9.59	68.7	8.49
Blanche à collet rose . .	790	550	70	5.7	9.77	62.9	8.60
Blanche à collet vert . .	650	590	91	5.9	11.20	69.8	9.84
de Bessey Óval:							
with scanty foliage . .	760	450	59	4.3	7.76	65.3	6.92
» abundant » . .	660	600	91	5.1	9.60	68.9	8.50

The writer carried out an especially large amount of research upon the connection between the colour of the leaves when the plants were pulled and the quality of the roots. On the same day, in a field where the beets were

being harvested, samples were taken of three series of lots having as closely as possible the same average weight. The 1st consisted of beets with yellow leaves, the 2nd of plants with leaves of the usual green colour, and the 3rd of those with dark green foliage. In each series, 3 lots were selected which differed with regard to the amount of foliage. Similar series were made with beets from a field that had been sown later, but in this instance, instead of considering the number of leaves a comparison was made between roots of different sizes.

Finally, in order to establish a possible connection between the ease with which beets are pulled up and the quality of the roots, two lots were compared, one consisting of beets requiring a moderate amount of force for their removal and the other of very firmly rooted individuals.

The general conclusions from these various researches may be summarised as follows:

1) There is a direct relationship between the sugar content of the beets and their foliar development with an optimum in the proportion of leaves.

2) Foliage reduction below a certain minimum is to be regarded as a sign of degeneration.

3) Plants with yellowish leaves have poorer roots than those with green leaves, given equal foliar development.

4) Conical beets, difficult to pull up, are richer than the ovoid roots which are easily detached from the soil, but the differences in analysis are not very great. This justifies the tendency to grow easily harvested beets, the more so because those with very strong tap roots often occasion, by breaking, considerable loss in the yield.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINAL CROPS

1045 - **The Coffee Industry in Costa Rica.** — Lee S. T. (San José, Costa Rica) in *The Tea and Coffee Trade Journal*, Vol. XXIX, No. 1, pp. 32-33. New York, July, 1915.

The development of the coffee industry in Costa Rica is shown by the following figures:

Year	Exports in lbs.	London Prices per 100 lbs.
1909-10	31 673 237	$ 10.14
1910-11	27 810 543	» 12.02
1911-12	26 923 325	» 15.07
1912-13	28 641 930	» 14.09
1913-14	38 977 550	» 14.16

During 1913-14, 75.8 per cent of the export was shipped to Great Britain, 10.36 per cent to Germany, 10.02 per cent to the United States and 3 per cent to France.

Generally speaking the cultivation is in the hands of native planters but in recent years British, American, French and German residents have taken up this cultivation. At the present time the Government of Costa Rica has no adaptable coffee lands for sale though virgin land at high elevations are available.

First-class coffee plantations in full production will realise about $ 250 er « manzana » (1.72 acres) or about £30 per acre. According to the Nat- onal Department of Agriculture the cost of producing coffee on good and is $ 2.50 per « fanega » (11 bushels fruit and equivalent to 125 lbs. f cleaned coffee) *i. e.* 7*s.* 6*d.* per 100 lbs. coffee, and the average yield is bout « 9 fanegas » per « manzana » or 660 lbs. per acre.

Fertile lands devoid of means of transport can be acquired at low prices ut the lack of transportation makes them practically unadaptable for offee growing.

FRUIT GROWING

940 – **Apples of the Cordilleras.** — FISCHER, WALTER in *The Journal of Heredity*, Vol. VI, No. 8, pp. 357-361, 2 figs. Washington, August 1915.

Roughly speaking, the wild apple country of the Cordilleras of Chile nd Argentina is cut in half by the 40th degree of latitude south, having total extension of about 200 miles north and south and lying on both sides f the continental divide. In Chile it extends to the Pacific coast and in rgentine to the eastern limit of tree growth. The heart of this apple ountry lies just north of the lake Nahuel Hapi, between the river Limay and he divide, and is drained for the most part by the Colloncura, a branch of he Limay and its extension the Alumine. The general level of the valleys s about 3000 feet. The minimum temperature so far observed was 70 F. he indigenous vegetation varies with the rainfall from dense rain forests ith almost impenetrable undergrowth and more open forests of Araucaria o **mountain meadows and dry grass lands.**

The apple is especially abundant in the valleys of the Alumine, the olloncura and their numerous tributaries, and reaches its greatest develop- ent in the regions of moderate rainfall wherever there is some protection om the cold dry winds. It is *Pyrus malus* L. and its fruit is of all sizes, rms, shades, flavours and degrees of sweetness and acidity. It is often a eavy bearer, which shows that in its new home it has found surroundings ill more favourable than those of its old habitat. The apples are often athered and made into cider or eaten by the numerous herds of cattle at range the mountains. The woolly aphis has commenced its depreda- ons among the trees and is fast penetrating to the most remote.

It appears that the apple was introduced by the Spaniards shortly ter the discovery of America and that it spread rapidly by natural means.

947 – **Manuring Experiments with Catalytic Manures applied to Vines.** — CETTOLINI SANTE in *Società degli Agricoltori Italiani, Bollettino quindicinale*. Year XX, No. 3, pp. 431-438. Rome July 15, 1915.

The experiments here described were carried out not only with the talytic substances enumerated in this paper but also with other fertilizers, ch as calcium sulphate and iron sulphate, in quantities much larger than ose which would have been adopted if they had been used as catalytic anures. These experiments were conducted at Catania, Sicily, in a vine- rd on loose, shallow soil derived from disintegrated volcanic rocks, and alternate plots so as to avoid local influences. The vines grown were ite "carricante" which had been grafted eight years previously on *Ru-*

pestris metallica. During this time the vineyard had been manured with farmyard manure and superphosphate. The results are summarised in the accompanying table.

An examination of the table shows that the fertilizing elements displayed their maximum action when they were given in a determined measure. Thus calcium sulphate was most efficient at the rate of 7.97 cwt. per acre ; iron sulphate at 3.98 cwt. per acre. The quantity in which sodium chloride was given seemed to be indifferent if the weight of the grapes only was considered, but not on the amount of must obtained. Aluminium sulphate yielded the best results in doses of 0.80 cwt. per acre. The same was the case with potassium permanganate, etc.

Taking into account the yield of must rather than that of the grapes, as the former determines more precisely the economical returns, the results obtained may be arranged in decreasing order of merit as follows, the quantities being those applied per acre, in hundredweights.

1) calcium sulphate : 7.97.
2) aluminium sulphate : 0.80.
3) manganese sulphate : 1.59.
4) potassium permanganate : 0.80.
5) iron sulphate : 3.98.
6) manganese sulphate : 0.80.
7) sodium chloride : 0.80.
8) iron sulphate : 2.39.
9) calcium sulphate : 6.37.
10) sodium chloride : 1.59.
11) iron sulphate : 6.37.
12) potassium permanganate : 6.37.
13) check plot.
14) aluminium sulphate : 1.59.
15) calcium sulphate 11.95.
16) sulphur : 1.99.
17) sulphur : 1.59.

In these experiments calcium sulphate acted as a real manure, supplying the lime in which the soil is deficient and probably also acting with its acid radical. The maximum quantity of ferrous fertilizer had a considerable action on the process of fermentation, especially in the sample in which the sugar content was high. Neither the must nor the wine showed any sign of turning black; the wine kept always clear and brilliant.

Sodium chloride seemed to favour the ripening of the grapes but also to cause an imperfect composition of the must ; fermentation is slow but the saccharomycete shows the greatest activity, and the wine appears good in its chemical composition and keeps well, but its colour is marked by an unpleasant reddish yellow tint. The taste would be good if it were not for a peculiar, almost brackish taste.

Aluminium sulphate gave the heaviest bunches and delayed their ripening, which may be an advantage in countries situated on the southern limit of the vine belt.

Results of catalytic manures on vines.

Number	Manure	Quantity of manure cwt. per acre	Yield of grapes cwt. per acre	Average weight of bunches in ounces	Yield of must: gallons per acre	Yield of must: Percentage of yield	Composition of must: Sugar %	Composition of must: Total acidity ‰	Index of ripening	Composition of wine: Alcohol %	Composition of wine: Acidity ‰	Composition of wine: Extract ‰	Composition of wine: Intensity of colour *	Ratio alcohol to sugar **	Observations on the wine
1	Check plot.	—	47.38	1.87	259.4	48,97	21,00	5.25	4.00	13.10	5.62	21.80	5	0,6228	opalescent, *mycoderma vini*
2	Calcium sulphate	11.95	39.82	2.93	228.2	51,25	21,30	6.75	3.15	13.40	6.00	21.00	3	0,6291	brilliant, sound
3	» »	7.97	92.39	4 58	584.3	56,50	20,80	6,00	3.46	13.28	6.40	20,50	3	0,6345	limpid, »
4	» »	6.37	47.79	3.17	296.7	55,55	22.30	5,00	4.50	14,03	6.45	21,00	3	0,6379	opalescent, »
5	Iron sulphate	6.37	43.81	2.20	292.2	58,50	22.90	6,60	3.38	14.30	6.49	23,00	3	0,6355	limpid, »
6	» »	3.98	60.53	3.35	345.1	51,00	19.30	6,00	3.21	11,96	5.80	21,70	3	0,6200	brilliant, »
7	» »	2.39	45.40	3.07	298.9	52,87	21,30	5.72	3.72	13.20	6.75	23,00	3	0,6197	« »
8	Sodium chloride.	1.59	47.79	2.93	290.1	54,30	21,00	5.20	4.03	13.40	6.00	24,00	4	0,6380	» »
9	» »	0.79	47.79	3.42	338.1	63,30	21,40	5,00	4.28	13.70	6.22	22,90	6	0,6372	» »
10	Aluminium sulphate . . .	1.59	35.84	3.00	226.3	56,50	20.90	7.50	2.78	12.80	6.97	25,90	3	0,6124	» »
11	» » . . .	0.79	56.55	4.65	448.8	70,00	19,50	9,00	2.21	12,00	6,37	22,60	3	0,6153	» »
12	Potassium permanganate. .	1.20	43.01	3.98	268.7	55,80	21,30	7.50	2.84	13,00	6,37	22,90	3	0,6384	» *mycoderma vini*
13	» »	0.79	56.55	3.32	375.2	59,35	23,00	6,00	3.83	14,50	5.90	21,50	3	0,6304	» »
14	Magnesium sulphate . . .	1.59	47.79	3.32	398.0	74,51	23.40	7.75	2.88	14.70	5.90	23,00	3	0,6382	» »
15	» » . .	0.79	54.16	3.07	343.9	56,75	22,30	6,00	3.71	14,10	6,15	22,50	3	0,6322	» »
16	Sulphur	2.00	31.06	2.82	202.4	58,25	21,40	5.10	4.19	13,60	5,32	22,80	4	0,6308	opalescent, sound
17	»	1.59	34.25	2.82	195.3	51,02	24.90	7.50	3.32	15.90	6.52	25,80	8	0,6389	» »

* Compared with wine from check plot taken as 5.
** The determination of sugars was made only with a mustimeter, thus the ratio has only a value as a means of comparison.

Noteworthy is the influence that manganese salts exert as catalytic manures. The sulphate gives a lower crop of grapes than the permanganate, but the percentage of yield in must is superior. The best results with permanganate were obtained by the smallest of the doses employed ; the sulphate, on the contrary, had most effect when applied in the largest doses; permanganate acts chiefly on the weight of the grapes, and the sulphate on the composition of the must. The salts of manganese gave a great effect on the formation of sugars, which is also accompanied by a high production of acids ; the grapes ripen less readily than in the control plot, still, however, with a high index of ripening. The must deposits a good deal of lees before beginning to ferment, it is somewhat turbid, and ferments somewhat slowly ; the saccharomycete utilizes the saccharine material well, yielding a high production of alcohol, superior to that of all the other samples. In the wine no sign of blackening appears ; in spite of the high alcohol content a film of *mycoderma vini* rapidly forms on the surface of the wine. The writer found the oxydase reaction barely noticeable in the must of grapes manured with manganese salts, and not at all in the wines. The wine was clear, straw-coloured and it very soon developed considerable fragrance, its taste was remarkably and persistently clean.

It seems that sulphur ameliorates the ripening of the grapes; fermentation is very rapid ; the utilization of the sugar by the ferment reaches almost the theoretical maximum. The wine clears slowly but then retains its limpidity. When sulphur is applied in excessive doses, wine acquires a taste which somewhat resembles that of garlic.

1048 – **The Mangosteen.** — Fairchild David (Bureau of Plant Industry, U. S. Dept. of Agriculture) in *The Journal of Heredity*, Vol. VI, No. 8, pp. 339-347, 4 figs. Washington, D. C., August 1915.

It was formerly believed that the mangosteen (*Garcinia mangostana*) could not live anywhere outside the Malay region. It has in recent years, however, shown itself capable of acclimatization in many tropical regions remote from its original home.

Its fruit, which the writer considers the most exquisite of tropical fruits, stands carriage fairly well. It appears that if it is carried in a dry, warm, close place (not too much ventilated nor put on ice) it keeps for 25 days without decaying.

In Java it is grown, but not on a commercial scale. At Singapore there are some small mangosteen orchards, that is, mangosteens mixed with other fruits. In Ceylon, where the species was introduced from the Straits Settlements about 1800, it is still a rare plant, though it thrives well in the island. The mangosteen has been acclimatized in the Madras Presidency (British India); at Saigon, where it was imported from Penang (Malacca) about a century ago; at Trinidad and Jamaica (West Indies); at Dominica; in Hawaii; in the Sulu Islands (Philippines), etc. At Porto Rico and in Cuba mangosteens grow but have not yet borne fruit. Several attempts have been made to acclimatize the tree in Florida and California, but without success.

About nine years ago the mangosteen was introduced into the Panama Canal zone and seemed to thrive, but the experimental garden was discontinued before any definite results had been realized. Lately, the work has been taken up again and gives promise of success.

The mangosteen requires to grow in the shade; it may be grafted on similar rapid growing species, such as *Garcinia indica*, *G. xanthochymus* upon which, however, it does not always succeed; by using the method of inarching or "grafting by approach" it may be grafted on twenty other species of *Garcinia*, especially on *G. tinctoria*, *G. morella* and *G. livingstonei*.

The writer is of opinion that of the 42 genera and 450 species belonging to the mangosteen family (*Guttiferae*) many deserve investigation as mangosteen stocks, though he does not think that much is to be expected from direct hybridization as it is so far superior to all its congeners.

1049 – **Investigation into the Retarding Effect of Lime on the Growth of Conifers.** — HOPKINSON, A. D., ELKINGTON, H. D. *Agricultural Students' Gazette*, New Series, Vol. XVII, Part 4, pp. 176-178. Cirencester, July 1915. FORESTRY

An investigation was started at the Royal Agricultural College Cirencester in 1914, the object of which was to ascertain the effect of varying quantities of calcium carbonate on the growth and development of certain conifers. Douglas Fir (*Pseudotsuga douglasii* Carr) was the species selected, since it is calcifuge. Two-year seedlings were obtained from a district where the soil contained insufficient calcium carbonate to affect their growth. Artificial soils were made from sand free from lime, 5 per cent. of leaf mould obtained from a beech wood, and varying quantities of calcium carbonate in the form of ground chalk. The soils were placed in specially prepared concrete pits, which were similarly situated and all adjoining, and the seedlings, 25 to a pit, were planted at equal distances from one another. The seedlings were planted in March and measured in the following May. Their heights were again taken in the May of the present year.

The conclusions which can be drawn from the experiments are summarised as follows:

1) Douglas Firs grow well in sandy soil with small amounts of calcium carbonate;

2) Increasing quantities of calcium carbonate up to 8 per cent. have a distinct retarding effect on their growth;

3) Above 8 per cent. of calcium carbonate, some factor, whose influence has not yet been established, dominates this retarding effect of the lime.

LIVE STOCK AND BREEDING.

1050 – **Piroplasmosis of the *parvum* Type in Cattle in the Lower Basin of the Mediterranean (Mediterranean Coast Fever).** — CARPANO, MATTEO, in *La Clinica Veterinaria, Rassegna di Polizia Sanitaria e di Igiene*, Year XXXVIII, Nos. 12 and, 13-14, pp. 498-529 and 553-596, 18 figs, 2 plates. Milan, June 30 and July 15 and 30 1915. HYGIENE

In Lybia as in the whole of the lower Mediterranean basin there is a special disease which attacks cattle and which is especially severe for im-

ported animals. Its course has an enzootic character with symptoms resembling those of the African East Coast fever and of tropical piroplasmosis: it is caused by the association of two piroplasms of the *parvum* type; *Theileria parva* and *Piroplasma annulatum*. In order to distinguish it from other similar diseases the writer calls this pathological condition " Mediterranean Coast fever ". The writer has studied it in Cyrenaica and reports, in the present paper, upon his researches and on their results.

He groups the piroplasmoses of the *parvum* type into: 1) not inoculable ones: Rhodesian fever or African East Coast fever, caused by *Piroplasma bacilliforme* (syn. *P. parvum* or *Theileria parva*; inoculable ones: 2) tropical piroplasmosis or Transcaucasian piroplasmosis caused by *Piroplasma annulatum* (syn. *P. tropicum*); 3) Pseudo-Coast fever caused by *Piroplasma mutans* (syn. *Theileria mutans*).

The piroplasmosis studied by the writer is unknown to the natives because, in the country itself, owing to immunity, especially of a hereditary kind, the disease appears sporadically and most frequently in a mild form. Imported cattle, and especially those coming from localities in which this infection does not exist, prove the most receptive. Thus, in the severe epidemic studied by the writer, the animals affected were almost exclusively Serbian cattle imported for beef and kept with the native herds in localities infested by ticks. Other cattle imported from Tunis, Sardinia and southern Italy had been some time previously in the same conditions of environment without presenting numerous and severe cases of infection. These observations lead the writer to believe that "as cattle coming from the latter localities contract the disease with difficulty or only in a mild form, they must undoubtedly possess a certain immunity due to regressive infections or to heredity ".

The Mediterranean Coast fever attacks more frequently young animals and females; in Cyrenaica it broke out in March and reached its greatest intensity in July. The disease can follow its course under three forms; 1) acute and sometimes very acute ; 2) sub-acute ; 3) chronic. The anatomical and pathological lesions are characterised by symptoms of congestion and haemorrhage which attack all the tissues of the organism. The writer describes them according to his macroscopic, histological and pathological examination and concludes that the species that he studied in Lybia (Bengasi, Ghemines and Soluk) are of the same nature as those described by several writers in Egypt, Tunis and Algeria and that this affection is not caused on the whole northern coast of Africa by a single microorganism, as was hitherto believed, but by the association of two haematozoa, which act at the same time, or nearly so, on the same animal. The haemo-protozoa found by the writer are, as has already been said, of the following types: 1) *Theileria parva* (syn. *Piroplasma parvum* or *Piroplasma bacilliforme*) identical with the one he had studied in Eritrea; 2) *Piroplasma annulatum* (syn. *Piroplasma tropicum*).

The writer gives a description of these two parasites according to the results of these researches. He finds a striking resemblance, both biological and morphological, between *Piroplasma annulatum*, *P. mutans* and *Nuttalia*

equi and he deduces the necessity for uniting them in a single group for the study and classification of piroplasms.

The onlytick found in large numbers on the coast of Cyrenaica is *Hyalomma aegyptium*, which lives, in its adult stage, on cattle, horses, asses and camels; it appears to be the carrier of *Theileria parva* and of *Piroplasma annulatum*.

The first of these two piroplasms is almost always non-inoculable, the second is easily transmitted by means of infected blood; these experiments on transmission have allowed the writer to isolate completely the two parasites and to study the pathological action of each.

No specific treatment is as yet available; the salts of quinine, endovenous injections of 1 per cent formol and the endovenous and subcutaneous injections of trypan blue did not yield any results.

The writer devotes some special chapters to the diagnosis, prognosis and prophylaxy of the disease and gives an appendix containing a bibliography with reference to 53 works.

1051 – **Sheep-maggot Flies**. — FROGGATT, W. W. (Government Entomologist) *Dept. of Agriculture, New South Wales, Farmers' Bulletin*, No. 95, 52 [pp., 4 plates. Sydney, March 1915.

The object of the above Bulletin is to condense all the information that has been obtained and published dealing with this matter since the appearance of the writer's report on "The Sheep-maggot Fly, with Notes on other Common Flies" (*Agricultural Gazette*, N. S. W. 1904, p. 1205, *Ibid*, 1905, p. 16) and to bring the whole of our information up to date.

A description is given of the following species, all of which have been identified on live wool: — Smaller Yellow House Blow-fly (*Calliphora oceaniae*), Golden-haired Blow-fly (*Calliphora villosa*), English Blow-fly (*Calliphora erythrocephala*), Reddish-brown Blow-fly (*Neo-calliphora ochracea*), Small Green Blow-fly (*Calliphora varipes*), Blue-bottle fly or Sheep-maggot Fly of Great Britain (*Lucilia sericata*), Bronzy Blue-bottle Fly (*Lucilia caesar*), Island Sheep Blow-fly (*Lucilia tasmaniensis*), Common House Fly (*Musca domestica*), Bush Fly or Raven Fly (*Musca corvina*), Stable Fly (*Stomoxys calcitrans*), Shining Black Fly (*Ophyra nigra*), Grey-striped Fly (*Sarcophaga aurifrons*).

Factors governing the spread of the pest. — The writer discusses the reasons leading to the adoption of the wool-blowing habit by various species of flies. Once this habit had become established the work of the sheep-breeders themselves, especially in Australia, in endeavouring to increase as much as possible the wool-bearing surface of the sheep, was instrumental in bringing about an increase in the numbers of the pest. The wrinkly stud Merinos were obviously particularly exposed to attack.

Sheep-maggot flies now occur throughout Australia wherever sheep can find pasture, but the greatest losses have been caused in New South Wales and Queensland. Sheep may be blown at any time of the year provided the weather conditions are favourable to the flies. The greater the rainfall and consequently the richer the pasture the more active the sheep

flies become in early summer. A dry, cold winter or an excessively hot dry summer seems to act as the greatest check.

Preventive Measures. — Most of the information under this heading has been obtained from investigations carried out from the Government Sheep-fly Experiment Station in the Brewarrina District.

It was found that most of the flies were congregated in sheltered areas and chiefly near water, these being the spots in which dead stock and other carrion, in which the flies breed, are invariably found. The writer regards all such decaying carcases and animal matter as the initial centres of infection and advocates their destruction as the first of the necessary preventive measures. When a recently dead animal is found, enormous numbers of flies can be attracted and killed by half skinning the carcase and slashing the flesh and then treating it with a solution of 1 lb. of arsenic dissolved by boiling in 5 gallons of waters. Such bait, however, loses its efficacy within the second day, owing to the action of the arsenic upon the flesh, but if the carcase be turned over the under surface can be treated and used in a similar manner.

Where the carcase or offal is already infested with maggots it should be burnt, but such burning should be carried out in a conscientious manner. If burning is impracticable the dead beast may be skinned and cut up, the paunch turned out, and left to the sun and the birds. The bulk of the maggots being protected from their enemies and the weather by the shelter of the dead body the mere turning over of this latter is of value.

Trapping. — Experiments are in progress on the use of traps or baits but no satisfactory method has yet been devised. Among the baits tried was a mixture of molasses with a solution of arsenite of soda ; the molasses in itself proved unattractive, its only value being to hold the arsenical wash on to carcase or meat baits.

Attempts to attract the flies by means of animal and vegetable oils have not yet met with any material success ; some 150 distinct mixtures were tried in this connection. Strong smelling putrefactive mixtures poisoned with arsenite of soda placed in tins, so devised as to prevent the access of birds or other animals while allowing free ingress to the flies, were successful in attracting these latter, but unfortunately they would not suck up the mixtures, at least not during the critical period.

Experiments with Washes, Dips and Powders. — Of ten samples of liquid dips tested, six failed to kill more than half the maggots in an hour's immersion, the remaining 50 per cent suffering no ill-effects. Dry powders were equally inefficacious. Carbolic and turpentine appeared to be the most penetrative chemicals in washes for treating fly maggots, but in combination with the oils used the latter appeared more lasting in effect.

" Bluestone " (Copper sulphate) has the advantage of deodorising the wool and thus minimising the risk of renewed infection, but its tendency to impair the quality of the fleece and to stain it a blue tint has caused it to fall into discredit.

In estimating the value of a specific, isolated trials are worthless. It has been found that the temperature of the wool varies very greatly, though

ot proportionately, with the temperature of the atmosphere; thus, a specific sed towards the end of November might have obtained a splendid testi-nonial, simply because the intense heat on the surface of the wool acted s a deterrent to the flies.

In all, 15 specifics, the property of various makers, were tested under xactly uniform conditions. These mixtures might be divided into 3 groups :

1. Dry powder dips dusted over the rump and rubbed into the wool.
2. Oil mixtures.
3. Mixtures emulsified with water.

The first group, although containing several highly recommended Brish specifics, proved unsuitable to Australian conditions.

Those in the second group gave the best results as regards killing or riving out the maggots, but nearly all matted and stained the wool.

The third group, though not always giving the best results in killing he maggots, left the wool in most cases in a much better condition for hearing.

The idea of inoculating the blood of the sheep in order to render them mmune is dismissed as valueless.

The value of other insects and birds in the control of this pest is discussed nd also the possibility of finding plants attractive to the flies as a means f trapping. The work of the Chalcid parasitic on the Sheep-maggot fly *Calliphora rufifacies*) has already been noticed in a previous *Bulletin* (1).

952 – **Phosphorus Metabolism of Lambs.** — Ross, E. L. (Fellow in Chemistry), Keith, M. H. (Assistant) and Grindly, H. S. (Chief, Division of Animal Nutrition, Dept. of Animal Husbandry, University of Illinois) in *Journal of Agricultural Research*, Vol. IV, No. 5, Washington, D. C., August, 1915. ANATOMY AND PHYSIOLOGY

The present paper gives the experimental data relating to the phosnorus metabolism of lambs when weighing, on the average, 115 lbs., and rms part of a series of investigations into the influence of different quanties of protein upon the nutrition of young growing lambs.

The rations fed consisted of alfalfa hay, shelled maize and old process inseed meal. The care of the animals and methods of analyses are described detail.

It was found that there are marked differences in the percentages of e different forms of phosphorus occurring in the feeds mentioned and in e ratio of phosphorus to protein. A large part of the phosphorus of alfa hay consists of the acid-soluble inorganic form ; that of maize of half id insoluble and half acid soluble, the soluble being largely organic ; and at of linseed meal is largely in the acid-insoluble form, the soluble being out equally divided between inorganic and organic phosphorus.

Fed with the ration stated, lambs excrete in the urine only 0.2 to 0.5 r cent of the total phosphorus ingested.

The forms of phosphorus excreted in the faeces show that the forms in feeds consumed undergo marked qualitative amd quantitative changes

(1) See *B.* Nov. 1914, N° 1017. (*Ed.*)

during the processes of digestion and metabolism. These changes result in only a small percentage of acid-insoluble phosphorus and a relatively large percentage of inorganic acid-soluble phosphorus being found in the faeces.

The results of the experiment indicate that the phosphorus requirement for the normal growth and fattening of lambs does not exeeed 3 gm per day per 100 lbs. of live weight. There is no evidence of correlation between the amounts of phosphorus retained in the body, on the one hand, and the amounts of phosphorus ingested, the amounts of protein ingested, or the body weights of lambs, on the other hand.

Variations in the quantity of digestible protein consumed, from 1.56 to 3.19 lbs. per 1000 lbs. of live weight per day, by lambs, do not influence significantly the forms of phosphorus in the faeces, the total phosphorus in the urine, or the total phosphorus stored in the animal body, expressed in percentage of the total phosphorus ingested.

1053 – **The Influence of Albumen and Its Derivatives upon the Formation of Glycogen in the Liver.** — RICHARDSEN, HEINRICH, in *Biochemische Zeitschrift*, Vol. 70, Nos. 3 and 4, pp. 171-190. Berlin, August 3, 1915.

The writer has been able to show that peptone introduced into the liver of the tortoise completely hinders the formation of glycogen. The same effect is produced on using hydrolised casein. Ereptone does not affect glycogen formation, neither does a compound of glycocoll, leucine, d-alanine and l-valine. Glutamic acid arrests the formation of glycogen.

It therefore results from these experiments that certain amido-acids are capable of hindering the formation of glycogen in the liver.

FEEDS AND FEEDING

1054 – **Grass Palatability Tests.** — BREAKWELL, E., in *The Agricultural Gazette of New South Wales*, Vol. XXVI, Part 6, pp. 485-486. Sydney, June 2, 1915.

During the summer 1914-15 (which followed a very wet spring) experiments were carried out at the Hawkesbury Agricultural College on the palatability of certain forage plants *viz.*:

Introduced grasses. — *Paspalum dilatatum; Chloris Gayana* (Rhodes grass); *Bromus inermis* (Hungarian Brome grass); *Poa arachnifera* (Texas Blue); *Lolium perenne*; *Bromus ciliatus* (Prairie); *Eragrostis currula* var. *valida.*

Native grasses. — *Eragrostis leptostachya* (Paddock Love Grass); *Andropogon intermedius* (Rare Blue Grass).

Each species occupied a quarter acre plot and the plots ran in adjoining strips.

Cows were turned on to the pastures morning and afternoon and observations made as to the time during which they fed spontaneously on the various plants and when they would eat certain grasses under compulsion. One experiment was made during the vegetative period and a second during the flowering and seeding period and included the species *Eragrostis abyssinica* (Teff grass).

During the first experiment the species most sought for by the cattle was *Bromus ciliatus*, followed by *Paspalum dilatatum* and *Bromus inermis*

In the second experiment *Paspalum dilatatum* was the most popular species, followed by *Bromus inermis*. In both cases *Chloris Gayana* was only eaten under necessity. The two native species were neglected for the cultivated grasses in both periods of growth.

To confirm this, bundles of *Andropogon intermedius* were placed before cattle in a yard but were refused.

These conclusions are not absolute nor final since the palatability of forage plants depends on the nature and composition of the soil, the climatic conditions and individual variations of the animals, etc.

1055 – **Decomposition and Formation of Albumen by Bacteria in Silos.** — STUTZER, A., in *Biochemische Zeitschrift*, Vol. 70, Nos. 2 and 3, pp. 299-305. Berlin, August, 1915.

The best fermentation is obtained in a silo by using lactic acid bacteria. The most satisfactory micro-organisms are those growing at low temperatures, like *Bacillus cucumeris fermentati*, which is often employed in Germany.

The writer studied this bacterium to ascertain : *a*) if it is capable of decomposing the albumen of the forage ; if it is able to form albumen by synthesis, as yeast does.

The object of the first experiment was to ascertain whether the bacteria can decompose the albumen of hay. For this purpose the writer subjected hay, with, or without, the addition of sugar, to the action of the said bacteria. The experiment showed that these micro-organisms are incapable of decomposing the albumen present in hay.

In a second experiment endeavour was made to determine whether *Bacillus cucumeris fermentati* has the power of forming albumen synthetically by means of asparagine, urea, or acetate of ammonia. If this were possible, it would be easy for the agriculturist to increase the albumen of forage by the addition of asparagine, etc. to the silo. The experiment, however, proved that the bacterium is incapable of forming albumen synthetically.

1056 – **The Industrial Utilisation of the Waste Product of Rice-Hulling.** — NOVELLI, N., in *Il Giornale di Risicultura*, Year V, No. 15, pp. 242-243. Vercelli, August 15, 1915.

The waste product of rice-hulling (" pule di riso "), which consists of the flour of the most external part of the mesocarp of the grain, and is produced by the decortication process, forms an easily digested and very rich feed with an especially high content of nitrogenous and fatty matters. The results of the experiments of the writer showed that " pula vergine " is superior to oats (dry grain) in protein and fatty matter of which it contains nearly three times as much (1).

In spite of its richness, this feed is practically only used in the agricultural districts or their neighbourhood where it is produced and in the coolest season when it does not ferment. The large quantities of this waste product and the readiness with which it becomes sour are obstacles to its

(1) See *B.* September 1915, N. 938. (*Ed.*).

wider diffusion. The writer therefore advises its conversion into cakes, by subjecting it to great pressure. Such cakes keep for a long time and are easily transported.

1057 - **The Effect Produced upon the Fatty Matter of Milk by a Ration Exclusively Consisting of Sugar Beets.** — BOES, J. and WERYLAND, H. in *Zeitschrift für Nahrungs und Genussmittel*, Vol. 29, No. 12, pp. 473-475. Munster in Westphalia, June 15, 1915.

The writer analysed a sample of butter coming from a farm where it had been necessary to feed the cows for a long time exclusively upon sugar beets, without giving them any other forage, such as straw, hay, etc. The butter was of normal colour, but excessively hard and its taste was unpleasant.

The analysis gave the results set forth in the following table.

Butter.

Water	14.79 per cent.
Ash	0.062 »
Casein and lactose	1.28 »
Degree of acidity	3.87 »

Fatty Matter of Butter.

Melting point	33° C.
Solidifying point	23° C.
Refractive index at 25° C.	51
Degree of acidity	3.61
Reichert-Meissl index	28.16
Polenske index	6.16
Saponification index	234.3
Iodine value	24.22

The butter is characterised by its small amount of ash, the great quantity of soluble volatile fatty acids, especially in the fatty matter, and the surprisingly large content of insoluble volatile fatty acids. The iodine value is very small. In spite of these characteristics, the butter is of about the same composition as that obtained by feeding cows on a mixture of beets and other food stuffs.

BREEDING

1058 - **The Influence of Lime upon Reproduction.** — EMMERICH, RUDOLF, and LOEW, OSKAR, *in Landwirtschaftliche Jahrbücher*, Vol. 48, No. 2, pp. 315-330. Berlin, August 6, 1915.

In a previous experiment, the writers found that female guinea-pigs which had been fed 0.1 gr. of $CaCl_2$ per kilogram of live weight for 8 months were more productive than others receiving none of this salt. As the nuclei of the reproductive cells contain a large quantity of calcium chloride, they continued their researches in order to determine whether a larger amount of calcium administered with the food could have an effect upon the maturation of the ova and the process of reproduction in animals.

Mice were first selected as subjects for experiment, then guinea-pigs and finally rabbits ; they were all divided into lots.

A basal ration was fed which remained constant in one lot throughout the experiment, while in the other lots, the salt to be studied was added to the ration. In addition to calcium chloride ($Ca\ Cl_2$), were also used ; magnesium chloride ($Mg\ Cl_2$), sodium chloride ($Na\ Cl$) and potassium chloride ($K\ Cl$). The amount of salt, which varied from 0.02 to 0.44 gm. per kilogram of live weight was administered by soaking bread in a solution of the salt. The salt was fed to all the animals concerned from the period before maturation of the genital organs in both sexes until the moment of parturition.

The experiments clearly showed that a larger dose of the lime increases not only the number in the litter, but also the number of litters.

Chloride of calcium is superior in this case to chloride of potassium or chloride of magnesium. The average weight of the newly-born offspring of mothers to which lime had been given was, however, a little less than that of the control litter. The best effect in the case of mice was obtained by giving 0.4 gm. of lime per kilogram of live weight.

Sodium chloride also increased up to a certain point, the number of litters. Chloride of potassium and chloride of magnesium, on the other hand, had no effect.

The larger production of young in cases where chloride of calcium was given did not decrease the live weight of the mothers. On the other hand, when the females were given chloride of sodium, a loss of live weight of 12 per cent after parturition was recorded.

The surprising part of these experiments is the bad effect of chloride of potassium. The writers advise the further study of this question. They think that the bad effects of this salt are due to the fact that bone development suffers when the amount of potash in the ration is increased while the amount of calcium remains the same, further, it has been observed that a stronger dose of potash injures the action of the heart.

The fact that the number of litters is larger in the case of the animals which received the calcium than in the control individuals may be due to 2 causes : 1) that the calcium excited the functioning of the ovary and that the latter produced a larger number of ova ; hence there were more ova in the uterus capable of fertilisation by the spermatozoa ; 2) that the uterus received the same number of ova from the ovary as in the case of the control animals, but the fertilisation of the ova was more successful owing to the good effect of the calcium. The writers consider the first explanation the more probable.

359 - **Experiments in Germany on the Abderhalden Method of Determining the Period of Pregnancy in Mares** (1). — BERNHARDT and HOFHERR, in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 33, pp. 385-389. Berlin, August 1915.

From experiments carried out on about 70 mares, the writers conclude that the ABDERHALDEN method is only of practical value when it is known how long it is necessary to keep the animal fasting in order that the ferments dissolving the nutritive substances in the blood may dis-

(1) See also *B.* January 1915, No 60 ; *B.* April 1915, No. 408. (*Ed.*)

appear. As long as this is not known, it will be impossible to distinguish in the blood between the ferments decomposing nutritive substance (called digestive ferments) and those breaking up the albumen of the placenta (specific ferments). The experiments of the writers have apparently shown that digestive ferments only disappear after some days' fasting. It would seem that it may therefore be concluded that ABDERHALDEN's method will never be of practical value in horse-breeding.

1060 – **Inheritance of Coat-Colour in Rabbits.** — PUNNET, R. C. in *Journal of Genetics*, Vol. 5 No. 1, pp. 37-50. London, July 1915.

In a previous paper (1) the writer, in order to account for the unexpected appearance of rabbits of the agouti pattern in litters from black parents framed an hypothesis based on the presence of three factors, *viz*:

A, the agouti factor which inhibits the full production of black pigment turning black into agouti, and tortoise into yellow;

E, a factor for the extension of the melanic pigment which turns yellow into agouti and tortoise into black; and

D, a factor which inhibits the operation of the agouti factor, causing the animal to appear almost or quite black even if the agouti factor be present.

It was suggested, in order to explain the experimental results, that complete coupling occurs between the factors *D* and *E* so that animals of the constitution *Dd Ee* produce only the gametes *DE* and *de*. The factor *A* however behaves in segregation independently of *D* and *E*. Owing to the coupling no animal which is heterozygous for *E* can be homozygous for *D*. The zygotic constitutions of animals containing *D*, *E*, and *A* are therefore limited to the following:

1. *DDEEAA*
2. *DDEEAa*
3. *DdEEAA*
4. *DdEEAa*
5. *Dd Ee AA*
6. *Dd Ee Aa*.

Nos. 1, 2, 5 and 6 should be normal blacks, Nos. 3 and 4 agouti-blacks.

One of the objects of the writer's present experiments was to find the animal of the constitution *DD EE AA*, which alone among the foregoing classes had remained unidentified at the time of the publication of the previous paper, such identification being of course critical for the hypothesis advanced.

Blacks resulting from the matings between agouti-blacks of the constitution *DdEEAa* were tested by crossing with a chocolate buck whose constitution in respect to the factors in question was *ddEEaa*. Fourteen does were tested in this way and gave results in close agreement with the ratio expected, further, the animal of the constitution *DDEEAA* was a normal black in appearance.

(1) *Journal of Genetics*, 1912, Vol. II, pp. 221-238.

If the theory as to the coupling of the factors *D* and *E* be correct agouti-blacks should always be heterozygous for *D*. In order to ascertain if this were so five F_3 agouti-blacks from agouti-black parents were tested and in each case the animal was shewn to contain *A* and to be heterozygous for *D*.

In order to test the nature of the coupling between the factors *D* and *E* a number of rabbits of the constitution *Dd Ee AA* were bred and mated with animals containing neither *D* nor *E*. As in no single case did agoutis result from such matings the writer infers that neither *dEA* nor *Dea* gametes were formed and consequently that if the coupling between *D* and *E* is not complete it must at least be of very high intensity.

The relations of the chocolate series to the factors *D* are considered in some detail. The experiments made in this direction established the fact that an animal which is pure chocolate in appearance can carry the factor *D*. The evidence obtained showed that there exists a chocolate series containing the factor *D*, *viz.* cinnamon, deep cinnamon and chocolate which is strictly parallel to the corresponding black series *viz.* agouti, agouti-black and black.

Experiments with blue rabbits showed that a blue rabbit may carry the factor *D* in the same manner as a black.

The writers considers his results admit of interpretation both on the "Presence and Absence" hypothesis (assuming that complete coupling obtains between *D* and *E*) and on that of "Multiple Allelomorphs". If this latter be accepted, and this means the complete abandonment of the "Presence and Absence" hypothesis in all cases of Mendelian inheritance, it is necessary to assume the action of three definite factors, any one of which is allelomorphic to any other, so that a given zygote cannot contain more than two of the three. In order to bring out the difference between these two explanations recourse is had to the case of the Himalayan rabbit recently discussed by Sturtevant (1). In the opinion of the writer, however, it would be premature to reject the "Presence and Absence" hypothesis so long as there are no facts which render such a step inevitable.

The paper is accompanied by a bibliography containing twelve references.

1061 – **Stock Breeding Conditions in the Districts of Benguela and Huila, Angola.** — Monteiro da Costa, Antonio and Mascarenas, Ruela Julio, in *Revista de Medicina Veterinaria*, Year XII, Nos. 155, 156; pp. 321-324; 359-365; Year XIV, Nos. 157 to 159, pp. 1-9; 45-50; pp. 79-86. Lisbon, January-May 1915.

STOCK RAISING: ORGANISATION AND ENCOURAGEMENT

In the interior of Angola and more particularly in the region of Quillenges, are bred in a condition of complete liberty cattle which are often provided with a more or less developed hump (a sign of an admixture of zebu blood); other animals, with or without a hump have pendent, swinging horns. The majority of these cattle have distinctly concave, sometimes rectilinear, profile; they are rarely over 5 ft.1 in. in height and are of elongated build. Their coat is very variable; in short, they show considerable variability with every intermediate degree between the extreme types.

The native cattle of the districts of Benguela and Huila which supply

(1) *Amer. Nat.*, 1913.

the municipal meat markets of Loanda, Benguela and Catumbela, are of bad build from the point of view of meat production, only yielding from 46.5 to 47 per cent of live weight and never totalling 4 cwt. per beast. Attempts have been made to convey them to Lisbon for slaughtering, but have not been a commercial success. At the same time the expoit of live cattle and of Benguela hides is very large. Benguela also exports a small quantity of beef preserved in brine and a certain number of sheep and goats. The live cattle exported are usually intended for slaughtering, but they are sometimes used as working beasts in the importing country. The cattle and preserved meat from Benguela are despatched, for the most part, to St Thomas Island and, in smaller quantities, to Loanda, Princes Island and, finally, to some ports of the Portuguese Congo.

In the higher districts of Benguela and Huila there is a fairly large number of horses that seem acclimatised ; on the other hand, in the town of Benguela, and generally speaking in the coastal region, only mules and asses are found.

The former come from Portugal or the Cape Verde Islands (the mule-breeding industry does not exist in the province) and the asses are of the ordinary breed reared in the country. Nearly all the asses are light grey in colour, they have the dorsal band and stripe and often the blaze of the mule and rarely attain a height of more than 3ft. 11 in. They are partly stall-fed and partly turned to pasture Some zebras are also bred.

Sheep are rare, the ewes are rarely milk producers. They, too, are partly stall-fed and partly grazed. Goat raising is little developed in the province; the methods are the same as for sheep, the animals being intended for milk and meat production. No farm has any European stud animals.

Representatives of the native breed of pigs are sufficiently numerous ; their bristles are usually dark, the snout compressed; the adults weigh between 130 and 200 lbs. There are also imported animals of Yorkshire, Essex and other breeds, these being bred either pure or serve to improve the native breed. The writers, however, taking into consideration the perfect acclimatisation of European breeds, advise the breeding of pure-bred animals for the purpose of entirely replacing the native stock.

In the district of Benguela, along the river Kavako, from its mouth to Mt. Bimbas, the writers have found the tsé-tsé fly (*Glossinia palpalis*) and have recorded the occurrence of trypanosomiasis among the animals, either indirectly, from the fact that stock-breeding has totally disappeared from the region infested by the fly, or directly from having observed it in goats. From its external symptoms, the writers think that *T. pecandii* is the species in question. The ticks observed were: *Margaropus decoloratus* and *Rhipicephalus appendiculatus*, the agents respectively for the transmission of *Piroplasma bigeminum*, the pathogenic agent of cattle piroplasmosis ("redwater", "tristeza" or "ferrujao") and of *Theileria parva*, the cause of East Coast fever.

In an excursion to the Catumbela Cotton-Growing Station ("Porto Algodoneiro") situated between Benguela and Lobito, the writers collected *Glossinia palpalis* var. *weilmani* Austen, *Hippobosca rufipes* and the ticks *Mar-*

garopus decoloratus Koch, *Eurhipicephalus appendiculatus* Neumann and *Eurhipicephalus evertsi* Neumann.

In addition, they were informed of the existence of the tsé-tsé fly up the Caiave (48 miles from the coast) along the Supúa (18 miles from the coast) and along the Hanha, where sleeping sickness is rife.

In the animals slaughtered at the Benguela slaughter-house, bovine (9 animals attacked out of 229 slaughtered) and swine cysticercoids (2 animals infected out of 27 killed) were found. The writers gave advice on the organisation of a Veterinary Department in the Colony and the prophylactic measures to be adopted there.

1062 – **The Zoological Relationship between the Banteng (*Bibos sondaicus*) and the Zebu (*Bos indicus*).** — GANS, HEINRICH in *Kühn-Archiv*, Vol. 6, Part. 1, pp. 93-152. Berlin, 1915. CATTLE

The question of the systematic position of the zebu and the banteng in connection with stock breeding has already been the subject of frequent studies, notably by DARWIN, RÜTIMEYER, KELLER, LYDDEKER and DÜRST, but the results obtained by these scientists are not in agreement

The writer first studied 50 banteng skulls and a number of skeletons and was able to distinguish 3 varieties of banteng showing great differences between them. There are: 1) the Bali animal, or *Bibos sondaicus domesticus* ; 2) the banteng properly so-called, or *Bibos javanicus typicus* ; 3) the continental banteng. These three types differ greatly from the three types of banteng found by LYDEKKER ; the writer gives a detailed description of them.

He afterwards studied, by means of a number of skeletal measurements, the zebu reared in the same regions as the banteng. He distinguishes 2 groups of zebus : 1) the group represented by the Gujrati breed ; 2) that chiefly consisting of the Nellore, Hissar and Mysore breeds. The Gujrati breed is the highest type.

In comparing the characters of the breeds of zebus with those of the banteng types, some are found to be common to both forms, although the analogy is not complete. The dorsal vertebrae of the zebu do not show by their direction nor by the form of their apophyses which are produced into sharp processes, any similarity with those of the domestic banteng (Bali animal) ; on the contrary, they more nearly resemble the vertebrae of our domestic cattle. The cleft at the extremities of the spinous apophyses shows a degree of development only found in the case of the zebu. The small size of the skull is a character common to zebu and banteng alike. In the Gujrati zebu, the shape of the horns recalls that of the horns of the female banteng. The direction of the ridge of the frontal bone in the zebu resembles that in the *primigenius* type, while the convex forehead is a characteristic of the zebu alone. The occiput of the zebu has exactly the *primigenius* character, although the distance between the two temples is a little smaller. The lachrymal bone has, in the zebu, a form intermediate between that of the banteng and of *B. t. primigenius*.

In conclusion, the writer states that KELLER's hypothesis, according to which the zebu is a domesticated banteng, is not confirmed. The zebu

shows, in its skeleton and skull, characters that also belong to *Bibos sondaicus*, as well as others which are only typical for the zebu. The writer therefore considers the zebu to be a type representing the extreme forms characterising *Bibos sondaicus* and *Bos primigenius*.

As regards its phylogeny these observations permit of three possibilities:

1) The banteng is the primary type from which the zebu has arisen; the intermediate forms are dead or, at least, unknown.

2) The zebu is a cross between *Bos primigenius* and the banteng.

3) The banteng, zebu and *Bos primigenius* have all sprung from the same primary type.

The last hypothesis, which is also supported by DÜRST, is the most probable and the writer recommends its further study.

1063 – **Black and White Ayrshires.** — KUHLMANN, A. H. (Dept. of Animal Husbandry University of Wisconsin) in *The Journal of Heredity*. Vol. VI, No. 7, pp. 314-322. Washington. D. C. July 1915.

Although black and white cattle are well known to Americans interested in dairying, owing to the popularity of the Holstein-Friesian breed, these colours are not usually associated with Ayrshires in America.

The American and Canadian Ayrshire breeders do not recognise the black and white cattle in their scale of points, which otherwise closely resembles the English, and very few such cattle are imported because American buyers think the colour shows the presence of Holstein blood.

The writer's enquiries in Scotland showed that a number of the leading Ayrshire breeders have one or more black and white animals in their herds many claiming that they are better producers than grades of the usual colours. Further, a count of several hundred animals in the local market showed that from 3 to 4 per cent grade Ayrshires were black and white. Such cattle, which often fetch a higher price, have the black and white markings distinctly separated in the typical Holstein manner, and there is apparently a tendency for the spotting to occur in large patches rather than in numerous small spots as is usual in Ayrshires.

Certain volumes of the Herd Book have been summarised to show the proportional occurrence of the various markings at different periods and to bring out such points, as a decrease from 1886 to 1913 of about 10 per cent in the number of white and brown cows, and the well known tendency to select sires with much white. An important point is that the first volume of the Herd Book to contain records of the colour of individual animals, *viz.* for the year 1885, shows that black and white animals were already accepted for registration at that date.

The writer further discusses the early history of the breed and the various theories propounded to explain the occurrence of the black colour, ultimately concluding that this colour is as old as the breed itself and that black and white Ayrshires are just as pure as those that show other colour

1064 - **Feeding Pigs on the Subcutaneous Matter of Hides Intended for Tanning; Experiments in Germany.** — ELLENBERGER and GRIMMER in *Berliner Tierarztliche Wochenschrift*, Year 31, No. 32, pp. 273-278, Berlin, August 12, 1915. PIGS

In tanning, as is well-known, only the corium of the hide is used, to the exclusion of the subcutaneous layer which is rich in fat and muscular substance. In Germany, this layer is chiefly used for glue, and is hence called glue leather ("Leimleder"). Of this raw material about 492 000 cwt. are produced annually in that country, an amount equivalent to 98 000 —148 000 cwt. of dry matter. Recently, this substance has also been recommended in Germany as a feed for animals.

In order to ascertain whether it was possible to use it for this purpose the writers made experiments in feeding it to pigs. They took three animals (3 months old), these received in turn, in addition to a basal ration, a given quantity of subcutaneous matter and of a mixture of pounded beans and vetches, the mixture being used in order to compare the subcutaneous matter with a commonly used concentrated feed.

The chemical compositon of the subcutaneous matter was as follows:

	Per cent
Water	13.2
Crude protein	55.0
Fat	26.5
Ash	5.2

The subcutaneous matter was used dry, and it was only towards the end of the experiment that fresh material was employed, such as is supplied by tanners to glue-factories.

The digestibility of the protein was 21 per cent and its starch equivalent 76.4 per cent. A strong ration (up to 730 gms.) was given in order to see if this feed imparted a disagreeable flavour to the pork. After the experiment, which lasted from April 23 to June 30, 1915, two pigs were killed and the meat examined.

These experiments agreed with those hitherto made for practical purposes in showing that the subcutaneous layer of the hides destined for tanning is well liked by pigs and not only does not injure their health but even gives normal development. It constitutes an excellent concentrated feed, equal in nutritive value to a mixture of crushed beans and vetches. The increase in live weight reached 596 gms. per day per head.

The flesh of the animals was proved to be normal in composition. The meat, when cooked, had an excellent flavour; in no case was any disagreeable taste detected in the meat, whether raw or cooked.

The writers recommend the subcutaneous layer as an excellent concentrated pig feed, capable of economically replacing other concentrates.

1065 - **Mineral Feeds for Hogs.** — MORGAN, H. T. in *The Country Gentleman*, Vol. LXXX, No. 30, p. 1215. Philadephia, July 24, 1915.

Forced feeding of early maturing meat animals demands a higher percentage of mineral nutrients than was necessary in the days of less intensive production. A supply of wood ashes should be placed at the

disposal of every lot of hogs and a still better plan is to mix the wood ashes with one fifth of their volume of salt and to add also a certain amount of charcoal.

The best way to supply the minerals is to place them before the hogs in self-feeders, the different elements being kept separate.

It has been found that by mixing them, the results have not in all cases been as satisfactory as when the hog is allowed to mix them according to his own requirements.

At the Iowa Experiment Station it was found that it was during the latter part of the feeding period that the hogs ate most freely of the charcoal. During the whole time the experiment lasted the hogs had access to charcoal, finely ground limestone and common rock salt. While up to the age of six or seven months the charcoal had been left practically untouched, all at once the animals acquired a great appetite for carbon. It was shown that hogs fed only on maize ate larger amounts of charcoal than those getting a variety of feeds.

Finely ground limestone is the best for hogs, although air-slaked lime may be used if the ground stone is not available. When air-slaked lime is used it is recommended that it be mixed with wood ashes or with cob charcoal in equal proportions and fed in self-feeders rather than mixed with slop. Ground rock phosphate may be used with profit. However, where tankage is used as a part ration there would seem to be but little need for either the ground rock phosphate or ground bone, as the tankage contains a relatively high percentage of bone phosphates. Ground bone dust is an excellent feed for hogs in dry lot feeding.

Sulphate of iron (copperas), is generally used by swine growers as a worm corrective. Two or three pounds of pulverized copperas to each 100 pounds of ashes is excellent and fed in this proportion will not be likely to cause abortion.

It has been definitely determined by experiments at the Wisconsin Experiment Station that neither ground limestone nor air-slaked lime will take the place of "floats" or ground rock phosphate or ground bone in the feeding of hogs that get too little mineral in their food. Hogs receiving a mixed ration will do fairly well without extra mineral material, if on pasture. It is the maize-stuffed hog that suffers most from a deficiency of minerals.

According to KELLNER, the hog requires from one-eighth to one fourth of an ounce of salt daily and in giving foods which are difficult to digest the salt in the ration should be considerably increased. The Wisconsin tests show that inorganic minerals were capable of satisfactory use in animal nutrition and that one per cent of the total grain ratio can be profitably made up of ground rock phosphate.

As to the amounts of the various minerals which the hogs will eat from self-feeders it is impossible to lay down a definite rule. Conditions or environment seem to determine in a large degree the amounts the individual will consume.

Where but few hogs are kept and it is not desired to supply the minrals in self-feeders the following mixture is recommended: Wood ashes 0 lbs., salt 15 lbs., air-slaked lime 20 lbs., or ground limestone 40 lbs., opperas 2 lbs., charcoal 10 to 20 lbs., ground bone 10 lbs. The whole is o be thoroughly mixed, and, of this mixture, a handful is to be given to ach pig twice weekly in thick slop.

066 – **Single Bird Testing for Egg Production** — *The Agricultural Gazette of Tasmania*, Vol. XXIII, No. 5, pp. 174-175. Hobart, May 1915. POULTRY

R. T. Terry, formerly Poultry Expert of the Department of Agriculure, New Zealand, has registered for one year the egg-laying of 4 Black Orpington pullets, 3 White Wyandottes and 6 White Leghors. The maximum and minimum number of eggs laid by the pullets in one year were respectively: For Black Orpingtons 266 and 200; for White Wyandottes 260 218; for White Leghorns 260 and 212. The experiments thus prove that it s not the breed so much as the strain which is important in egg-laying capacity. The number of pullets which laid more than 200 eggs per annum vas approximately half the number of each of the three breeds, thus giving almost the same number for each breed. Black Orpingtons and White Wyandottes, however, have the advantage of being at the same time table birds.

067 – **Experiments in Germany on Feeding Acorns to Fowls**. — HINK, A., in *Deutsche Landwirtschaftliche Tierzucht* Year 19, No 29, pp. 228-229. Hanover, July 16, 1915.

The acorns were decorticated, pounded and dried and then mixed with bran and sugar.

30 gms. of this mixture were given daily per fowl. In addition, the owls received a mixture of bran, potatoes and green fodder. The result as a decrease in egg-laying, culminating in complete cessation.

The yolk of the eggs was covered with a dirty coloured brown membrane, he interior of the yolk also being affected. No constipation was observed the fowls.

The writer considers that these results are due to the tannin contained in the acorns. Although the amount of this substance is small, it is fficient to affect the ovary of the hen. The albumen tannate formed in he digestive tract passes in the form of tannate of albumen and tannate of da into the blood, where fresh tannin is liberated and excercises its astrinnt action upon the capillaries of the ovary. The brownish colour of the olk of the egg is due to oxidation.

The fact that the fowls laid more eggs when this feed was discontinued a proof that the acorns were the cause of the decrease in egg-production.

68 – **The Possibility of Improving the Production of Eggs in the United States.** — MORMAN, JAMES, B., in *The Country Gentleman*, Vol. LXXX, No. 32. p. 1272. Philadelphia, August, 1915.

The most recent statistics show that the average egg yield in the United ates reaches 6 dozens per fowl per annum. The weight of eggs is ry variable as shown by the following figures given by the Department Agriculture.

	Weight per dozen ounces
Eggs from poor flocks of Southern barn-yard fowls	19 1/5
Eggs from average Tennessee or Texas farm flocks.	21 1/3
Eggs from Kansas, Minnesota, South Illinois, representing the average for the United States	23
Eggs from specially bred flocks in Southern Iowa.	24

These results show that conditions are capable of great improvement. The writer's poultry gave an average of 148 eggs per annum per bird and from a one year old pullet he has obtained eggs weighing 32 ounces per dozen, that is, during the first year when the eggs are smaller than in later years. The writer draws attention to the experiments conducted at several Experiment Stations in the United States, which show that the size of eggs is not influenced by feeding, but being dependant on the strain and vigour of the birds can be improved by selection.

1069 – **Report on the Eleventh Open Egg-Laying Contest at the Queensland Agricultural College, Gatton April 1, 1914 to March 31, 1915.** — PITT, P. M. in *the Queensland Agricultural Journal*, Vol. III, Part. 6, pp. 241-244. Brisbane, June 1915.

Forty groups of 6 pullets took part in this contest, *viz:* 32 White Leghorns, 4 Black Orpingtons, 2 Brown Leghorns, 2 Silver-laced Wyandottes, 1 Rhode Island Red. The number of eggs laid during the contest was 54 202 or 1335 per pen and about 226 per pullet. Arranging the 40 groups according to the number of eggs laid, the first six places belong to the White Leghorn and the 7th place to the Black Orpington (1441 eggs). The maximum number of eggs per group was 1545 (White Leghorns) and the minimum 1149 (also White Leghorns). The total value of the eggs laid was £ 248-10*s*.-1*d*. and the cost of feeding was £ 84-16*s*-8*d*. this latter being much higher than in the preceding year owing to the high price of foods.

The ration was composed as follows:

Morning feed:

Pollard	14 lbs.
Bran	9 1/2
Sunlight oil cake	1 1/2
Meat meal	1 1/4

mixed with water into a paste, the above quantity being sufficient for 240 birds.

At midday:

Chopped green lucerne, a large handful for each 6 birds; and once or twice a week the same quantity of meat soup.

Evening: about 2 oz. per bird. On Sunday mornings and certain other occasions the bran and pollard were replaced in the morning meal by peas and oats. The birds had shell grit and fresh water at their disposal.

070 – **The Possibilities of Sericulture in British Colonies and Dependencies, with Special Reference to the Rearing of Wild and Semi-Wild Silkworms.** — *Bulletin of the Imperial Institute*, Vol. XIII, No. 1, pp. 87-100. London, January-May 1915.

The most important wild silkworms of Africa belong to the genus *Anaphe* (1). Among all the species of this genus the cocoon is composed or woven by several larvae working in common and the life cycle lasts for more than one year. This is why artificial rearing indoors does not appear practicable, and all that can be recommended to the natives is the collection of larvae on the trees near their houses. Experiments have already been made in this direction in Uganda with success. For some years wild cocoons have been collected, spun and woven into silk.

Of the Asiatic silkworms *Attacus ricini* (Eri silkworm) (1) appears the most suitable for rearing in the colonies where the temperature varies between 60° to 90° F., the air is not too dry and labour abundant. This insect may be reared in the open on the castor oil plant as well as artificially. Artificial rearing has been successful in several provinces of British India, Ceylon and the Philippines. Further, the leaves of *Ricinus communis*, *Heteropanax fragrans*, *Jatropha curcas*, *Zizyphus jujuba*, *Gruelina arborea*, *Carica papaya*, *Plumeria alba*, *Manihot* spp. may be used as food.

Two other Indian silkworms, *Antheraea paphia* ("tussar") and *A. assama* ("muga") (3) are adapted to artificial rearing; only the first lays eggs indoors and the other can only pass indoors the period between the spinning of the cocoon and the hatching of the eggs, the remainder of the life cycle being spent on the trees in the open.

Antheraea paphia which produces "tussar" or "tasar" silk lives wild in several regions of India, in jungle land up to an altitude of 4000-5000 ft. In some places of the Central Indian Plateau the natives rear the worms on the trees. The larva feeds on the leaves of many kinds of trees but when fed for several days on one species it refuses the others. *Terminalia tomatosa* ("asan") is the most suitable and along with *Shorea robusta* "sál" it is the most used.

There are about three generations per annum and the duration of one generation is very variable; the chrysalid stage ranging from less than a fortnight (in the case of white cocoons with long peduncle) and six or seven months (for brown cocoons with short peduncles). Oviposition takes place during the 24 hours after the escape of the moth. The eggs hatch 8 days later and the larval period lasts from 1 ½ to 2 months.

The small cocoons with long stems are chosen for egg production as these mature more regularly, but as they contain the feeblest insects, a fresh supply of wild cocoons must be obtained after a few generations.

The larvae may fall victims to the attacks of various Ichneumonidae and Tachinidae; *Masicera grandis* is a particularly destructive parasite.

The cocoons are boiled in a lye or allowed to ferment for two or three

(1) See *B.* December 1912, No. 1665. (*Ed.*).
(2) See *B.* Sept. 1912, No 1331. "
(3) See also *B.* Dec. 1912. No. 1664. "

hours and then unwound. The reeled silk is treated first with a warm acid solution, followed by an alkaline solution and finally washed. It is then dried and packed for export.

Antheraea assama is reared in Assam chiefly on *Machilus odoratissima* ("sum tree"); it also feeds on the leaves of *Tetranthera glauca* ("dighlate tree"), *Cinnamomum obtusifolium* ("patichanda tree"), *Symplocos grandiflora* ("bambroti tree"), *Litsaea citrata* ("mezankuri tree"), *Michelia* sp. ("champa tree"), etc. There are about five generations per annum. The chrysalis state lasts about two weeks in the hot season and three weeks in the cool season. The majority of the eggs (about 250 per moth) are laid during the first three days following the escape of the moth. The eggs must be kept in a dark place when they hatch in seven to ten days after deposition. The larval period varies from twenty-six days in summer to forty days in winter, during which time there are four moults. The entire life cycle lasts about fifty-four days in the warm months and eighty-one days in the cold months.

The outer layer or floss is pulled off and the cocoon is reeled as far as the innermost layer next the chrysalis. The floss, as well as the silk immediately round the chrysalis that is not reeled, are utilised by spinning instead of reeling. One thousand cocoons yield about ¼ lb. of silk, if they belong to the winter generation, and double the quantity if belonging to the summer generation. Muga silk resists washing better than any other kind of silk fabric.

1071 – **First Report on the Experiments Carried out at Pusa to Improve the Mulberry Silk Industry.** — De, M. N. (Sericultural Assistant, Pusa Research Institute) in *Agricultural Research Institute Pusa, Bulletin*, No. 48, pp. 1-6. Calcutta 1915.

The decline in Sericulture in Bengal and other provinces of India is represented by a decrease in the value of the exports of silk from 15 532 290 Rs. in former times to 5 055 288 Rs. in recent years. Various attempts have been made from time to time to improve the industry by selection and hybridisation and the importation of superior races but without any practical results being obtained.

In these experiments carried out at Pusa since 1910 the following methods were followed:

1. Crossing of imported univoltine races with indigenous multivoltine races and selecting the multivoltine eggs from the self-fertilised progeny so to obtain a "selfing" multivoltine crossbreed.

2. Crossing Bengal multivoltine with Mysore multivoltine races and selecting so as to produce a superior and resistant race of native origin.

3. Crossing a foreign univoltine race with an indigenous univoltine race so as to obtain a resistant univoltine race suitable for the climate of India.

4. Comparing bush mulberry leaves with tree leaves in feeding univoltine races. (Several attempts have been made to introduce foreign univoltine races since the time of the East India Company with indifferent results owing to lack of knowledge of their requirements).

5. Using artificial stimuli in breeding from precocious univoltine ggs without the use of cold storage.

6. Improvement of the cocoon by careful selection of the best spe-imens of indigenous races.

7. Rearing worms on the trees in nets and bags.

The writer gives a short description of eight different races of silkworms eared in India and elsewhere and compares their characteristics and yield f silk.

The results of hybridisation show that the brood character is maternal n the first generation but that there are complications in the later genera-ions. Univoltine eggs may occur in successive generation though the parent ayings were multivoltine.

As regards brood characters the results do not appear to conform to Mendel's law or indeed any law. It is possible to get superior cocoons from eggs from a cross between a multivoltine female and a univoltine male. By pairing the univoltine males obtained in the second generation with a multivoltine female the next generation eggs will be multivoltine and the cocoons produced by them will be superior to the best multivoltine race.

Pure multivoltine eggs obtained from the female moths which have been fertilised by males from a different locality, yield better silk and are more resistant to disease than eggs obtained by crossing moths of the same locality.

In all cases more silk is obtained from worms fed with tree-mulberry leaves than from those fed with bush-mulberry leaves.

Imported univoltine eggs should be reared in preference to indigenous races ; they can be bred easily in October and February and at any other time when the temperature varies from to 65°-85° F. One successful univoltine crop in spring is better than three or four indifferent multivoltine crops. The imported eggs can be made to hatch simultaneously with the acclima-ised univoltine eggs in 3 or 4 days if the eggs are preserved in hill stations or in an ice factory for about 4 months. The races obtained by crossing Italian with Japanese races yield better results than pure univoltine races. The use of artificial stimuli *e. g.* oxygen gas and strong acids in hatching univoltine eggs did not give satisfactory results. Worms reared outside on trees yield less silk but are more resistant to disease than those bred indoors. The former are admirably suitable for reproduction purposes, but the method of rearing is very expensive.

The attempts to establish a fixed multivoltine hybrid race which will not degenerate are still being continued.

FARM ENGINEERING.

072 - **Agricultural Implements in American Export Trade.** — *Commerce Reports*, No. 167, pp. 294-295. Washington, D. C., July 19, 1915.

AGRICULTURAL MACHINERY AND IMPLEMENTS

Exports of American agricultural implements during the fiscal year 915 (12 months ended June 30) totalled approximately $ 10 500 000, as gainst $ 40 600 000 in the high-record year 1913, $ 21 000 000 in 1903,

and a yearly average of more than $ 29 000 000 for the past decade. Thi loss of trade fell most heavily upon sales to Europe, but there were als smaller though significant decreases in shipments to Argentina, Canada and various countries of Africa and other sections of the world. Cuba an Siberia made gains. Australia barely held its own in the years' trade, bu this is a good showing in view of the fact that her wheat crop droppe from over 100 000 000 bushels in 1913 to 25 000 000 bushels last year.

The European war was doubtless the dominant factor in the great fal ing off in American exports of agricultural implements in the fiscal year jus ended, since the decrease in sales to Europe was disproportionate to tha in sales to other sections. Thus U. S. exports of agricultural implements t European Russia, usually the greatest of foreign markets for this class c American manufactures, practically ceased, as did also those to Germany while huge losses likewise occurrd in sales to France and other Europea countries. Another contributory factor was the recent establishment c great plants in Russia and France, financed and controlled by America capital, for the manufacture of farming machinery.

Information reaching the U. S. Department of Commeıce, howeve indicated a growing use of machinery on farms both in Europe and elsewhere a tendency which will doubtless be even more prononced upon the resump tion of peace, since the devastation of war in causing a marked shortage i human and animal labor, necessitates proportionately more machiner for the successful conduct of farming. Russia, for example, possesses one seventh of the entire land area of the world and an even larger proportion c the land devoted to cereal crops, which require for their cultivation mor machinery than most other classes of farm products. General depressio in Canada, Argentina, and elsewhere, so reduced buying power in 1914-1 that new agricultural machinery has not been purchased in the usual quanti ties, but with a restoration of normal conditions American manufacturers wi doubtless find larger markets than ever before.

A decennial record of our exports of agricultural implements in the hal century from 1863 to 1913, the high-record year, with an estimate indicat ing the big drop in 1915, is presented in the following table compiled by th Bureau of Foreign and Domestic Commerce (amounts for 1863 and 191 being estimated) :

Fiscal year	Value
	$
1863	500 000
1873	2 600 000
1883	3 900 000
1893	4 700 000
1903	21 000 000
1913	40 600 000
1915	10 500 000

A comparison of the U. S. exports of agricultural implements to lead ing markets for the eleven months ending May 31, 1914 and 1915, is show by the following table:

Exported to —	Eleven months ending May 31	
	1914	1915
	$	$
European Russia	6 438 000	83 000
France	3 884 000	1 153 000
Germany	3 132 000	20 000
United Kingdom	1 062 000	704 000
Other European countries	4 147 000	1 481 000
Canada	2 842 000	1 643 000
Argentina	4 216 000	1 455 000
Africa	1 445 000	542 000
Other countries	3 136 000	2 369 000
	30 302 000	9 450 000

1073 – **The "Rhino" Subsoiling Plough and the "Cyclone" Ditcher.** — *The Implement and Machinery Review*, Vol. 41, No. 485, pp. 584-585 and 586-587. London, Sept. 1915.

These machines resemble each other in that in both of them the chief feature is a U-shaped steel cutting blade.

In the "Rhino" this blade is attached to a light but strong plough-like frame on wheels drawn by horses or bullocks. It can be regulated to cut to any depth down to 20 inches by 14 in. wide, and it is built sufficiently strong to stand the strain of any team, even where stones and stumps abound. It can also be fitted with a special drain cutting blade and mouldboard which will cut out and complete a drain 12 in. deep by 14 in. wide.

This machine was recently tried at the Hawkesbury Agricultural College, New South Wales. It went through fairly hard ground that had never been ploughed deeper than 6 or 8 inches; whilst when the U-shaped blades were attached to a double furrow plough, ploughing and subsoiling were accomplished at one operation to a depth of 16 inches. It left the soil in exactly the same position it occupied before without mixing the top with the subsoil, only thoroughly loosening them throughout the full depth.

The "Cyclone" ditcher for drainage or irrigation work is also drawn by horses or bullocks. It cuts the soil a few inches at a time by a U-shaped knife and the loosened soil is lifted out of the ditch by mouldboards behind the knife and deposited on both sides of the ditch. The depth of cut each time is under the control of the operator. At one trial it cut a ditch 10 in. wide by 28 in. deep at the rate of 1 ½ miles per day at a cost of 4 *d.* to 6 *d.* per chain (66 feet). In other trials it opened trenches down to an average depth of 3 feet. It is stated that a number of these machines are in use in the United States, Canada, New Zealand and Australia.

The accompanying figure 1 shows the "Rhino" subsoiling plough entering the ground, and fig. 2 the same subsoiler attached to a double furrow plough.



Fig. 1. — "Rhino" Subsoiling Plough.

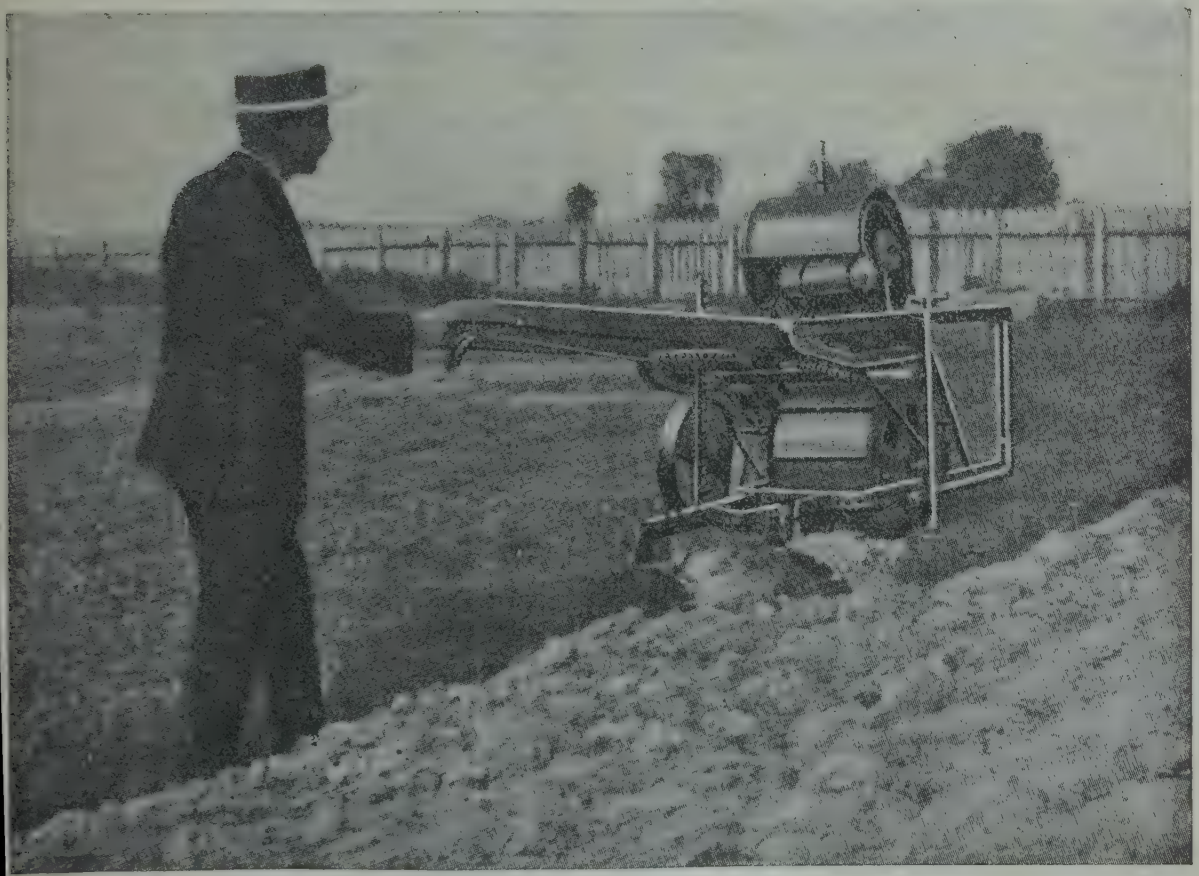


Fig. 2. — Subsoiler attached to a double-furrow plough.

1074 – **New Motor Plough for Light Work.** — TARCHETTI A. in *Giornale di Agricoltura della Domenica*, Year XXV, No. 34, p. 270. Piacenza, August 22, 1915.

The Motoaratro (motor plough) invented by Messrs, L. GALARDI, a civil engineer of Milan, and PATUZZO jun., of Verona, for small and medium holdings, especially for shallow ploughing, or for deep ploughing in light soils, seems to answer well to the demands made upon it.

The apparatus consists of a frame in the shape of a parallelopiped or iron cage fitted at the back with two long wooden bars which the operator uses like the handles of a plough. The motor is situated in front inside the



Motor-plough invented by Messrs. Galardi and Patuzzo.

frame, it is not seen in the accompanying illustration because it is hidden by the driving wheel. Any petrol or benzine motor may be used. By means of belting, it drives, (on the right of the figure) the ventilator of the radiator placed on the frame, and (on the left) a counter-shaft fixed on the left hand handle ; this countershaft in its turn, by means of a speed reducing gear and endless chain, moves the driving wheel.

This latter is a sheet iron drum fitted with a certain number of cleats with which it grips the soil. At the two lower angles at the back of the cage the extremities of a C shaped frame are hinged. To this frame the ploughs are hitched as to the usual fore-carriages of ploughs. A vertical rack which gears into a horizontal cross piece placed between the two handles is fixed by

an articulated joint to the plough beam. The machine is thrown into and out of gear by a spring lever worked by the operator's right hand like the brake of a bicycle. A similar spring lever worked by the operator's left hand shifts the belting from the fixed to the loose pulley of the countershaft and thus stops the progress of the machine and the ploughing without stopping the motor. The apparatus is completed by a small cylindrical tank for the petrol and by a light road wheel on the left of the cage. The whole machine is easy to manage.

As ingenious details the following are to be noted: the radiator, which is very simple, original and effective; the grips, which can be easily removed from the drum and changed according to the nature of the soil to be ploughed; the drum, which proceeds on the land just in front of the ploughs, thus avoiding the tendency to swerve which is so injurious to the performance of the machine and yet so frequent in those outfits in which the driving wheel runs on the bottom of the furrow. The result is that once the proper position of the plough beam has been found, the steering of the Motoaratro is so sure that the operator can let the handles go while the machine continues by itself on a straight course. Another important point is the surprising ease with which the sharpest curves can be turned to the right or left without hardly any effort on the handles.

Completely equipped, the machine costs, in normal times, about £120. The one which the writer saw while being tried had a Belgian, one-cylinder, 3 to 4 HP motor; the drum was 16 inches wide and 28 inches in diameter and was provided with 12 grips projecting about 2 inches. The total weight of the machine with ploughs and petrol was 836 lbs.

Two small ploughs of the EBERHARDT type had been hitched to the motor, they were provided with coulters but had no jointers; the strip ploughed was about 20 inches wide and 6 to 7 inches deep, on meadow land with a shallow but very hard turf and loose subsoil. The work done in 10 hours was about 3 ½ acres and the total cost of the work including amortizement, upkeep etc. did not exceed in any case 4 *s* per acre.

1075 – **Agricultural Transport by Tractors.** — RINGELMANN MAX, in *Journal d'Agriculture Pratique*, Year 79, Nos 51 and 52, pp. 475-476 and pp. 486-487. Paris, July 15 and 29 1915.

The carriage of certain crops, especially beets, presents difficulties under normal conditions and it is anticipated that with the increasing shortage of hands and teams caused by the war these difficulties will increase considerably.

Many farms had often to employ carters and teams for the conveyance of beets to the sugar mill when they should have been engaged in carting manure and preparing the land for winter or spring sowing, and thus delayed these operations till late in the season.

In order to provide against this state of things some farmers in the north west of Lizy-sur-Ourcq, representing some 5000 acres of land, of which 1125 acres was under beets, founded in 1909 a cooperative association which built, at a cost of £12668, of which £7696 for the line and the rest for

olling stock, a narrow gauge railway (23.6 inches gauge), 4.78 miles long, rovided with two locomotives and 60 trucks, each capable of carrying tons.

In 1913, during 80 days, this line conveyed 20200 tons of beets an verage distance of 3.73 miles. The quantity of beets shows that the onvenience of carriage had allowed a greater extent of land to be devoted o this crop.

This initiative suggests that other means could also be employed to ope with the lack of men and animals, and among them powerful tractors ith four driving wheels, such as are used by the military authorities. The ollowing data refer to the Chatillon-Panhard tractor capable of carrying tons besides towing other vehicles weighing up to about 15 tons:

	Weight	
	Empty. tons	Full. tons
	—	—
Tractor:		
Load on front axle	2.706	2.756
» rear »	2.214	4.134
Total . . .	4.920	6.890
Lorries:		
Two lorries	4.920	14.764
Total . . .	9.840	21.654
Load carried		11.814

In these trials the 21 ½ ton train, consisting of tractor and lorries, ravelled at an average speed of 1 ½ miles an hour over a bad road with ome steep gradients and at 5 to 5 ½ on a better road. The tractor alone, unning empty, made 10 ½ miles.

Assuming a speed of 3 miles an hour when loaded, and 6 miles empty, nd allowing time for loading etc. the tractor could perform in 10 hours, five rips carrying 11.8 tons of beets each time a distance of 3.1 miles, that is, n average of 182.9 ton-miles a day. The consumption of fuel is about 1 ¾ allons costing 3 *s* 2 *d* for the run out and home or 1.03 *d* per mile-ton for uel. For this must be added the wages of two men (driver and assistant), ubricants, repairs, amortisement, etc.

Limiting the weight of beets carried to 44 or 49 tons per day, in 80 days, s with the cooperative railway, the above tractor would carry from 3520 o 3920 tons of beets a distance of 3 miles, that is the crop of 206 to 328 acres.

In comparison with the best motor lorries it was found, during the 1912 rials, that the load carried by them was 45 per cent of the total weight, hile with the tractor it is 54.54 per cent besides effecting an economy of per 1000 in fuel.

It need hardly be mentioned that both before and after the beet arvest the tractor can be used for conveying hay, cereals, manure, roots, als, etc.

1076 – Review of Patents.

Tillage machines and implements.

Canada	161 774. Sharpener for harrow disks.
	162 126. Digging machine.
	162 295. Shovel and hoe.
Cuba	2 290. Improvements in ploughs.
Denmark	20 340. Hoe.
	20 414. Hoe for root crops.
Italy	145 342. Machinery for sterilizing the soil by means of heat.
	146 773. Endless track with projecting teeth for motors hauling ploughs or the like.
	146 800. Apparatus for ploughing, sowing, watering and the like.
	147 654 — 148 457. Motor ploughs.
	147 862. New balance plough.
	148 281. Improvements in cable-hauled ploughing outfits.
	148 474. Rotary plough.
Sweden	38 658. Device for fixing bolts on harrows.
	38 725. Rotary tilling machine.
	38 760. Hand gardening implement.
United Kingdom	7 575. Motor driven disk plough.
	9 122. Motor ploughs, harrows, etc.
United States	1 145 136. Surface mulcher.
	1 145 147. Rotary plough.
	1 145 212 — 1 145 943 — 1 147 420. Ploughs.
	1 145 240. Twin rotary harrow.
	1 145 643 — 1 146 072. Harrows.
	1 145 790 — 1 145 964. Cotton choppers.
	1 147 241. Weed digging machine.
	1 147 281. Disk harrow.
	1 147 543. Plough attachment.
	1 147 588. Stalk cutter attachment.

Manure distributors.

Switzerland	70 095. Manure spreader.
	70 383. Manure spreader with manure box, distributing reel, etc. for use on a cart.
United Kingdom	9 153. Manure distributor.
United States	1 144 544. Manure carrier.
	1 146 152. Manure spreader.

Drills and sowing machines.

Italy	147 837. Sowing machine and manure distributor combined.
Sweden	38 435. Potato sowing machine.
	38 727. Seed drill.
	38 950. Adjustable shafts for sowing machine.
United Kingdom	8 087. Potato planter.
United States	1 144 625 — 1 145 714. Corn planter.
	1 147 480. Planter.

Reapers, mowers and other harvesting machines.

Canada 161 885 — 162 042. Stooking machine.
Italy 148 309. Improvements in mowers.
Spain 60 484. Harvester.
Sweden 38 562. Improvement in horse rakes.
38 728. Rake with metal teeth.
United Kingdom 9 597. Lawn mowers.
United States 1 144 386. Straw stacker.
1 144 679. Adjustable platform for harvesting machines.
1 144 848. Grain shocker for harvesters.
1 145 010. Flax pulling and harvesting machine.
1 145 282. Peanut harvester.
1 145 697. Mower.
1 145 863. Corn cutting and shocking machine.
1 145 878. Attachment to sheaf binders.
1 145 890. Corn picker.
1 145 919. Heading machine.
1 146 244. Hay rake and stacker.
1 146 785. Grain harvester.
1 146 966. Side delivery rake.

Machines for lifting root crops.

Denmark 20 259. Machine for lifting and topping roots.
United States 1 145 538 — 1 145 785 — 1 146 575. Beet harvesters.

Threshing and winnowing machines.

Sweden 38 729. Winnower.
United Kingdom 8 294. Apparatus for cleaning or removing dust from chaff or the like.
United States 1 144 368. Fanning mill.
1 146 900. Band cutter and feeder for threshers.

Machines and implements for the preparation and storage of crops.

Canada 161 927. Grain food apparatus.
162 043. Flax machine.
Italy 147 835. Silo with moveable plate and mechanical compression.
148 066. Straw elevator on two wheeled truck which can be coupled to threshers.
148 510. Silo with moveable plate and compression by rack and pinion.
148 511. Silo with moveable plate and compression by water power or by weights.
148 512. Silo with moveable plate and compression by means of a winch.
148 621. New fodder press.
Sweden 38 659. Potato sorter.
Switzerland 70 281. Process and plant for the treatment of cereals to be stored.
United Kingdom 7 714. Machine for moulding cattle food.
United States 1 145 111. Frame for stacking straw.
1 145 202. Silos — 1 145 306. Silos.
1 146 680. Baling press.
1 146 866. Elevator for corn huskers and shredders.
1 146 936. Hay fork.

Dairying machines and implements.

Canada	161 788. Cheese box.
	162 111. Package for milk, etc.
	162 296. Milking machine.
Denmark	20 273. Milking machine.
	37 880. Milk can.
	38 119. Pulsator for pneumatic milking machines.
Sweden	38 399 — 38 732. Milking machines.
	38 400 — 38 437. Churns.
	38 530. Improvement in milk separators.
	38 730. Driving wheel for separators.
	38 884. Revolving churn.
Switzerland	70 435. Stirrer for cheese dairies.
United kingdom	8 452. Cow-milker.

Other agricultural machines and implements.

Canada	161 864. Folding poultry case.
	161 984. Egg carrier.
	162 075. Animal feeder.
Cuba	2 293. Improvement in the rollers or crushers of sugar cane mills.
Denmark	20 285. Pipe for smoking out bees.
Italy	147 543. Container for oil meals in hydraulic presses.
	147 793. New system of pumps for deep wells.
	148 165. Improvements in sulphurers.
	148 173. Canvas drinking trough with foldable iron frame.
	148 262. Portable auto-inhaler for large animals.
	148 381. Farm motor car.
	148 382. Piston sulphurer.
	148 467. Multiple nozzle for sprayers.
	148 506. Improvements in shrub planters.
	148 545. Improvements in continuous-jet sprayers.
Spain	60 277. Yoke.
	60 426. Wine press with removable parts.
	60 430. Apparatus for raising water.
Sweden	38 563. Apparatus for cleaning small fruit.
	38 660. Apparatus for warming green houses by the heat of the sun.
	38 726. Wheel for motor tractors.
	38 808. Device for floating tree trunks.
	38 885. Rat trap.
Switzerland	70 279. Apparatus for the preparation of unfermented alcohol-free fruit and grape wine.
	70 385. Drinking trough.
	70 438. Cask for the storage, carriage and retailing of unfermented fruit juices.
United Kingdom.	8 204. Electrical egg-testing device.
	8 243. Automatic feeding and drinking appliance for animals and birds.
	8 347. Coco-nut husker.
	9 263. Fruit picker.
	9 620. Receptacles for fruit etc.
United States	1 144 737. Windmill.
	1 144 915 Draught equalizer.
	1 145 540. Neck yoke.
	1 147 131. Attachment for converting motor-propelled vehicles into tractors.

977 – **Cement Drain Tile in Alkali Soils Tested for Durability.** — *Engineering Record*, Vol. 72, No. 8, p. 220. New York, August 21, 1915.

BUILDING CONSTRUCTION

The United States Bureau of Standards has conducted a series of investigations for the purpose of determining the effect of the strongly alkali soils and waters in the arid regions of the western part of the United States upon cement mortar and concrete.

The results of the first year's investigations have now been reported by Messrs R. G. WIG and G. M. WILLIAMS in *Technologic Paper* 44.

Laboratory investigations were started in 1908 by the technological branch of the United States Geological Survey and they showed that practically all cements are attacked by alkali waters upon exposure in the laboratory and complete disintegration can be obtained under certain conditions. But, as in laboratory tests conditions often differ from those of actual service, field investigations were undertaken.

The Bureau of Standards made a field survey of some concrete structures exposed to alkali waters in the Western States and found several portions of structures about eight years old more or less disintegrated. Owing, however, to the difficulty of analysing some of the failures observed it was deemed desirable to make field tests in which concrete of known composition and fabrication would be exposed to the influence of alkali soils.

About 8800 hand and machine made cement drain tiles of various proportions of cement and sand varying from 1 : 1 ½ to 1 : 4 were prepared and installed in 8 projects in the most concentrated alkali soils in the West, and, for comparison, in some practically alkali-free projects.

The first physical tests of the tiles were made in 1914, the results are generally uniform and the conclusions drawn from them are the following:

Special care should be observed in employing only the best materials and workmanship in the manufacture of tiles for the more concentrated alkali soils.

Cement mixtures not leaner than 1 : 3 are apparently unaffected when exposed for one year in very concentrated alkali soils, and mixtures leaner than this should not be used in such soils.

Drain tiles of 1 : 4 mixture are apparently not affected by exposure of one year in moderately concentrated alkali soils.

These investigations will be continued.

RURAL ECONOMICS

978 – **The Cost of Production in Missouri Farms.** — JOHNSON, O. R. and FOARD, W. E. in *University of Missouri College of Agriculture, Agricultural Experiment Station Bulletin*, No. 125, pp. 289-316 Columbia, Missouri, February 1915.

RURAL ECONOMICS

The University of Missouri Agricultural College, with the cooperation of the Office of Farm Management, U. S. Department of Agriculture, began in 1910 their investigations into the cost of producing various farm

products under Missouri conditions, and the cost of labour and of team work. The data used as basis for the calculations have been supplied by 46 farms in different parts of the State, but for each special investigation only the most reliable data were used.

The principal results of these investigations are as follows :

The average expense of using equipment, which, in the Missouri farms averages $3.24 per acre, amounts to 2.28 cents per hour of work. This figure has been found by determining the cost of upkeep of the equipment (repairs, taxes, interest, decrease of inventory or depreciation) and dividing it by the number of horse hours put in on the farm, because equipment is always used when horses are used and seldom used without horses. *Vice versa*, in order to determine the cost of upkeep of equipment, it is necessary, only, to multiply the number of horse hours by 2.28.

The cost of keeping horses amounts on average to $88.33 per head per annum ; of this sum $ 68.31 or 77.4 per cent is for feed, $ 9.46 or 10.7 per cent for labour and caring for the horse, and $ 10.56 or 11.9 per cent for miscellaneous expenses such as interest on investment, taxes, veterinary expenses, shoeing etc.

The average length of work day per horse for the year is 3.57 hours and the cost of horse labour per hour is 7.9 cents. The average length of work-day per man varies in the different months from 8.09 hours per day in January to 10.57 hours in June, the average for the year being 9.6 hours whilst the average cost of man labour is 12.8 cents per hour.

The writers then calculated the number of hours of man and horse labour per unit of area required by the different crops. The results are shown in Table I :

TABLE I. — *Labour requirement per acre of farm crops.*

Crops	Man hours	Horse hours
Maize	23.92	42.32
Oats	10.83	19.48
Wheat	11.78	11.37
Soybeans	24.73	36.31
Cowpeas	24.25	40.00

With the help of the above data the writers determine the cost per acre of producing the principal crops raised in Missouri, as is shown in Table II.

TABLE II. — *Cost per acre of producing the various crops.*

Crops	Man labour	Horse labour	Seed	Equip-ment	Use of land taxes, interest etc.	Manure	Threshing	Total
aize. . . .	$ 3.074	$ 3.596	$ 0.275	$ 1.021	$ 5.164	$ 0.392	$ —	$ 13.522
heat . . .	2.050	2.313	1.138	0.792	5.029	—	0.978	12.300
ats	1.155	1.333	0.989	0.452	5.724	0.075	1.145	10.870
over . . .	1.588	1.084	0.581	0.438	4.133	—	0.280	8.106
owpeas . .	2.355	2.559	1.987	0.545	5.616	0.443	0.098	13.603
oybeans . .	2.917	3.859	1.406	0.584	4.544	0.224	—	13.534

The cost of keep per year for milch cows where just enough are kept o supply home needs is as follows:

	Feed Cost	Labour Cost	Miscellaneous Cost	Total
verage	$ 26.81	$ 18.06	$ 3.08	$ 47.95
er cent cost. . .	55.92	37.66	6.42	—

If the milch cows are kept for the sale of dairy products the net income per cow per year was as follows

Total Cost	Total income	Loss
$ 85.16	$ 80.92	$ 4.24

In calculating the cost, 5 per cent was considered as interest on investment, the feed was set down at market price, 14 cents per hour for man abour and 7.4 cents per hour for horse labour. Thus, these cows paid interst on the money and all other expenses but paid the keeper only 11.4 ents per hour for his labour.

The cost of keep per brood sow per year amounts to $ 25.91, of which 18.70 or 72.52 per cent for feed, $ 4.52 or 17.44 per cent for labour and 2.60 or 10.04 per cent for miscellaneous cost. Lastly, the average cost of eeping poultry averaged, under ordinary conditions, 65.7 cents per hen er year.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

79 -- **Contribution to our Knowledge of the Physiology of *Mycoderma Vini*.** — PEROTTI, R. in *Annali di Botanica*, Vol. XIII, Part 2, pp. 169-184. Rome February 1915.

The first experiments on the nutrition of this fungus deal with the influence of carbohydrates as follows: the influence of the relation between e sources of carbon and nitrogen; the influence of the acidity of the edium; the influence of the alcohol. The conclusions of these researches e summarised as follows:

1) The most suitable carbohydrate for the growth of *Mycoderma vi* is glucose, followed by galactose.

2) The amount of glucose most favourable is 2 per cent.

3) The most suitable nitrogen compounds appear to be asparagin an ammonium tartrate.

4) Medium percentages of these two substances (1 per cent) consider ably retard the development of the fungus.

5) A degree of acidity corresponding to 0.5 per cent of tartaric acid harmful whilst 5 per cent is fatal to its development.

6) The most favourable percentage of alcohol is from 4 to 5 per cen from 9 to 10 per cent checks its development.

1080 – **Fig Honey as a By-product in the Dried Fig Industry.** — SCEVO, PIETRO, in *Nuo Annali di Agricoltura Siciliana*, Series VI, Year 4, Part II, pp. 110-117. Palermo, 1915.

The writer describes the dried fig industry in the commune of Carin (Palermo, Sicily) where it takes more the character of a home industr rather than a commercial enterprise. The black and white "dottati" fig are used for the purpose, the white variety being preferred since its seed are less numerous and less hard after drying than those of the black variety The usual method of sun-drying the ripe figs, whole or cut longitudinall is practised, but there is also another method much in vogue which is no practised elsewhere and which has the advantage of giving an accessory pro duct known as fig honey resembling cooked condensed must in its colou density and flavour.

The figs are placed in baskets and plunged for five minutes in a larg pan of boiling water, the quantity of water being proportional to the amoun of fruit. When softened, the figs are placed in a special wicker baske resting above another vessel to receive the liquid rich in glucose whic drains from the figs. From time to time this liquid is added to that in th first pan and gradually concentrated to the consistency of a syrup. Th drained figs are then exposed on screens and dried in the sun.

Drying requires very little more time than the usual method and th resulting product is as much sought after as that of unboiled figs.

1081 – **Use of Papyrus in the Manufacture of Paper Pulp** (1). — *Journal of the Roya Society of Arts*, Vol. LXIII, No. 3268, p. 772. London, July 9, 1915.

Papyrus grows in large quantities along the banks of the Upper Nile where at certain places it covers both banks for more than a kilometre In 1908, researches were begun at the "Wellcome Tropical Research La boratories" in Khartoum to determine the value of papyrus in makin paper pulp. As far as experiments on a small scale can be relied upon th results are full of promise. The experiments have been continued and th Research Chemist of the above Laboratories, DR. BREAM, has recently pub lished an account.

Experiences on a large scale were undertaken by the "Sudd Fuel Com pany" under the direction of Messrs CROOS and BEVAN.

(1) See *B.* March, 1913, No 310. (*Ed.*)

The value of the papyrus as paper-making material is said to be almost equal to that of esparto and, further, papyrus has the advantage of providing a pulp almost equal in colour to the standard of ordinary bleached supply and may be used as such without requiring to be mixed with wood or with other long fibres. The raw material in the form of air dried stems was valued at about £ 3 per ton delivered in England.

1082 – **The Influence of Temperature and Food upon the Physical Condition of the Fat Globules of Milk.** — VAN DAM, W. in *Molkerei-Zeitung*, Year 23, No. 25, pp. 193-194, No. 26, pp. 201--202. Berlin. June 1915.

The writer first gives a summary of the most important theories regarding the changes in the physical condition of fat globules under the influence of changes of temperature. He then refers to experiments of his own undertaken for the purpose of showing : 1) the temperature at which the fat globules of milk begin to solidify ; 2) the effect of the duration of a given temperature upon their solidification ; 3) whether the change in volume of the globules in response to the change of temperature, occurs very rapidly or not; 4) the influence of the above factors upon the quality of the butter ; 5) whether the nature or the composition of the fodder have an effect upon the physical condition of the fat globules.

The experiments, made with the aid of a dilatometer filled wih fat globules (cream, etc.) and submitted to various temperatures, gave the following results.

1) Fat globules which have been solidified through cooling below 0° C. undergo a change in volume as soon as they are subjected to a higher temperature. This change in volume attains its maximum between 11 and 20° C. and is much less in a temperature below 10° C.

2) The changes in volume due to the cooling of the fat globules take place very rapidly at first and afterwards more slowly. The equilibrium in volume corresponding to the reduced temperature is only reached after some weeks or even months. After having been cooled for 21 hours at a temperature of 0° C, followed by warming, the equilibrium is only attained with any rapidity at a temperature of about 11° C.

3) By keeping the cream for 21 hours at a temperature of 16° C., it was found that the globules remained liquid ; on keeping it at 13° C., part was half solidified and when the temperature was maintained at 11° C., all the fat globules of the cream were half solidified. When the cows were kept in their sheds somewhat higher figures were obtained.It is possible in certain cases, (*e. g.* by feeding beets to the cows), to obtain solidification even at a temperature of from 18 to 20° C. As a rule, the critical temperature for the change in the state of the fat globules is to be found between 12 and 16° C.

4) In cream in which the volume of the fat globules was in normal relationship with the temperature at the beginning of churning, no solidification of the globules was produced during the process of churning. This has been proved a number of times. After a preliminary cooling for 21 hours at a temperature of 11° C. it is possible to find a slight continuation of the solidification of the globules during churning. This, however,

was more noticeable than when the cream was cooled to 13° C.; in the case of cooling to 16° C. the continuation of solidification was still less perceptible.

It may be concluded from this that fatty matter kept at a temperature favourable to acidification undergoes very little change in volume. The prevailing opinion that most of the globules become solidified during churning, is therefore in no wise confirmed.

5) Before churning, it is necessary to try and solidify the fat globules as much as possible, for cream containing solidified fat globules can be churned at a higher temperature. In this way it is possible to avoid all trouble caused by changes in the condition of the fat globules during churning.

6) The degree to which the temperature is reduced has a more marked effect upon the change in condition of the globules than the duration of the cooling. Thus it has been found that after a preliminary cooling for 4 hours, at a temperature of from 6 to 8° C., solidification was more rapid than after a 21 hours' treatment at 11° C.

7) Cooling to a low temperature (6° C.) is especially to be recommended in autumn.

8) These results explain the success obtained with the density method of SWARTZ.

If cream with a uniform content of fatty matter, but from different cows, is cooled for 21 hours at a temperature of 12° C., a varying amount of dilatation is observed in the fat globules when the cream is subsequently heated. The maximum dilatations were 188 units, the minimum 125 units, in 10 000 units of volume.

10) The nature of the cows' food has a considerable effect upon the dilatation of the fat globules, as many experiments have proved. In the same way, any change in the animals' mode of life such as the descent from the alpine pastures to their winter quarters, or *vice versa* is also clearly demonstrated by the dilatometer.

The iodine value of the fat globules is in direct relationship with the solidifying power, which shows that combinations of oleic acid have a preponderant effect on solidification. There are, however, some exceptions in cases where the iodine value is very small and where consequently there is very little dilatation.

12) A cream containing globules which only dilated to a small extent gave in many experiments, a soft butter, whereas in cases where the dilatation was considerable the butter produced was hard. In every case where the iodine value corresponded imperfectly to the dilatation, this latter corresponded better to the consistency of the butter.

1083 – **Method for the Rapid Separation of the Pure Fatty Matter from the Non-Fatty Constituents of Milk.** — KORPACZY, ST., in *Zeitschrift für Untersuchung der Nahrungs, und Genussmittel*, Vol. 30, No. 1, p. 24. Münster in Westfalen. July, 1, 1915.

In order to determine whether milk fat has been adulterated with other substances the butter is generally melted and then filtered to separate the fatty matter from the other constituents ; by this means a completely pure fatty substance is obtained. This method has, however, the disadvantage

of requiring 5-10 hours. During this time, the fatty substance may easily be oxidised or absorb colouring matters from the combustion of the casein adhering to the walls of the globule. The writer therefore tried to accelerate the separation of the pure fatty matter, by adding to the butter a substance which absorbs water and does not alter the fat. The substance used was burnt gypsum.

The maximum effect is obtained from the gypsum by using it in excess and mixing it cold with the butter. In addition, the mixture must be left untouched for a certain time in order to allow the water to combine. When this occurs the butter is melted and the whole mass filtered, the fatty substance passing through the filter very rapidly. The residue remaining on the filter may even be pressed with a glass rod without either the water or plaster passing through. The writer observed that the fatty substance does not absorb even traces of the plaster and that its constants remain entirely unaltered.

As the plaster mechanically retains a large amount of the fatty substance a double quantity of butter must be used. The best proportion is 4 parts by weight of butter and 1 part by weight of plaster.

The preparation of the pure fatty substance is effected as follows: 40 gms. of butter and 10 gms. of pure, finely ground calcined plaster are well mixed with a spatula in a flat porcelain dish. The temperature in the capsule should be low, or at least not high enough to melt the butter. The homogeneous matter is left for about 10 minutes, after which it is melted and finally passed through a dry filter. By this means, at the end of 1 hour, 20 to 22 gms. of pure fatty substance are obtained.

1084 - **The Reaction and Calcium Content of Milk as Factors in the Coagulation Process.** — MILROY THOMAS HUGH (Department of Physiology, Queen's University, Belfast) in *The Biochemical Journal*, Vol. IX, No. 2, pp. 215-228. Cambridge, June 1915.

The work of MICHAELIS and MENDELSSOHN on the coagulation of milk by means of acid and rennin has shown that the zone of rennin action is not simply an extension of the acid precipitation zone. By treating the milk with an acetate mixture to avoid the increase of acidity produced by the addition of calcium chloride, they found that the action of calcium in rennin coagulation is not simply an expression of the rise of acidity due to the dissociation of the chloride.

The writers conducted the following experiments to study the effect of variations in the acid (H′) and calcium content on the coagulation process. To do this effectively it is necessary to control one factor while the other is subject to variations. The (H′) content of fresh milk was first determined in a number of samples and then the change in (H′) content was followed during the coagulation process. It was found that there was no definite change in the (H′) content of milk either in the early stage or in the actual separation of the clot, such as might have been expected to occur from the fixation of calcium by soluble casein causing a rise in the (H′) as in the case of pepsin digestion. The addition of potassium oxalate which retards coagulation lowers, whilst that of calcium chloride raises the (H′) content.

The change in (H′) content on heating was then investigated. It was

found that fresh milk which has been subjected to a temperature slightly below boiling point for one hour shows a rise in (H′) though its coagulability is diminished. Analysis showed a diminished calcium content in solution due to the separation of calcium phosphate in more basic form. The addition of calcium chloride and sodium acetate so as to raise the calcium content without changing the (H′) content restored the coagulability of the milk. It is therefore concluded that the lack of coagulability brought about by heating is due to a diminished calcium content, and that the coagulability may be raised by adding calciun chloride, which acts not simply by raising the (H′) content but also by raising the soluble calcium content.

Acid coagulation under conditions of diminished calcium content was then investigated. It was found that more acid is required when the calcium content is diminished. In the absence of rennin coagulation takes place on the acid side of the rennin zone of action, but the latter gradually approaches the former as the calcium content is lowered. It is therefore probable that the rennin zone of action is an extension of the acid zone of coagulation towards the neutral point.

Finally, the rôle of calcium salts was studied under conditions of reduced (H′) content. Three similar samples of heated milk were treated as follows : an equal amount of rennin was added to each ; number 1 was treated with calcium chloride and all were kept at a temperature of 38° C. Number 1 clotted in 4 minutes. Sample number 2 was then boiled to destroy the rennin. Calcium chloride was then added to both samples, Nos. 2 and 3 and both were kept at 38° C. Number 3 clotted in 1 minute whilst number 2 remained uncoagulated.

Thus, although number 2 had previously been digested with rennin at 38°, it was not clotted by calcium chloride after the rennin had been destroyed.

It is therefore concluded that calcium chloride does not complete a process begun by rennet, but acts throughout the whole period of fermentation.

1085 – **Pasteurizing Milk in Bottles and Bottling Hot Milk Pasteurized in Bulk.** — Ayers, S. Henry (*Bacteriologist*) and Johnson, W. T. Jr. (*Scientific Assistant, Dairy Division*) in *U. S. Department of Agriculture, Bulletin* No. 240, 27 pp., 10 figs. Washington.

The object of these experiments was to compare the pasteurization of milk in bottles with the process of bottling hot pasteurized milk, and in particular to determine the bacterial reduction in each process, to study any special points which must be considered in the operation of each process and to present preliminary data on the cooling of milk in bottles by an air blast. Infusion agar was used in the work, the plates were incubated for 5 days at 30° C. (86° F.) and counted. The pasteurizing of the milk in bottles was carried out as follows : the bottles containing the milk and capped with patented metal caps were submerged in hot water at a temperature of from 62°.8 C.-63°.8 C. (145-147° F.). After the temperature in the bottom of the bottles had reached 62°.8 C. (145° F.) they were kept at that temperature for 30 minutes. The method of pasteurizing the milk before putting it in the bottles was the commercial one. The fact that the bacterial counts were taken directly after heating has no effect upon the results, since it has been

nown that cooling plays no part in the destruction of bacteria in the pasteur-ing process.

After having described the apparatus used in their laboratory experi-ents, the writers give a description of the machines used in large commer-al plants.

The process of cooling milk by a blast of air had not yet been applied to ie pasteurization of milk. This process consists of keeping the milk in ottles and sterilising it afterwards by means of a forced-air draft. Ordinary ard-board caps may be used in this system.

The results obtained by the writers were as follows :

1) The process of pasteurization in the bottle, using a temperature f 62°.8 C. (145° F.) for 30 minutes, causes satisfactory bacterial reductions. n the average of 22 experiments this reduction was 96.50 per cent when the ilk had been placed in washed, steam-sterilized bottles. It was 88.34 per ent when washed bottles were used that had not been sterilized in steam.

2) Bottles should be steamed at least two minutes before being filled ith milk in order to destroy heat-resistant types of organisms that might rvive the pasteurizing temperature and thereby increase the bacterial unt.

3) Care must be taken to register the temperature in the bottom of the ottle during the heating process. When the milk at an initial temperature 10° C. (50° F.) is heated in bottles without agitation in water of about °.3 C. (146° F.) the temperature of the milk in the top of the bottle will ach 60° C (140° F.) about 9 minutes before that in the bottom. The tem-rature of the milk during the process of pasteurization in the bottle should recorded by placing a thermometer in a control bottle with the bulb of e thermometer about one-half inch from the bottom. The milk should be ated for 30 minutes at 62°.8 C. (145° F.).

4) When bottles are heated and cooled under water care should be ken not to use any with chipped or otherwise imperfect tops, since the l caps may allow leaks during the process of pasteurization. It is advis-le for the users of patented seal caps to assure themselves that the caps water-tight, since leaking caps may cause dangerous infections, parti-larly if the cooling water is polluted.

5) The process of bottling pasteurized milk while hot in hot steamed ttles causes equally good bacterial reductions as does pasteurization in ttles. Even with the same length of exposure of 30 minutes and the same mperature of 62°.8 C. (145° F.), the bacterial reductions are often much ater than those produced by pasteurization in bottles.

6) In the process of bottling hot, bottle infection is eliminated, even en several cubic centimetres of old, sour milk are added to bottles before ng. The two-minute steaming period to which the bottles are subjected ore filling with hot milk is sufficient to destroy the contamination, at st so far as bacteriological methods can detect.

7) Laboratory experiments indicate that milk may be pasteurized, ttled hot, capped with ordinary cardboard caps and cooled by a blast of d air.

8) It is probable that if milk is cooled from 62°.8 C. to 10° C. (145° to 50° F.), within 5 hours, no more bacterial increase will take place duri the slow cooling than would take place if the milk were cooled immediate to 10° C. (50° F.), whether or not this will be true under commercial conditio can be determined only by future experiments.

9) So far as laboratory experiments indicated, when milk is heated 62° C. (145° F.), for 30 minutes, the bottling of the hot pasteurized mi followed by slow, gradual cooling has no more appreciable effect on t cream line or flavour of milk than the ordinary process of pasteurizatio This is true of cooling periods of less than 5 hours' duration.

10) Since milk contracts on cooling, a quart bottle filled with mi at 62° C. (145° F.), does not hold a full quart when the milk is cooled 10° C. (50° F.). It is about 0.62 of an ounce short. Therefore slight over-sized bottles should be used.

11) The advantages of the process from the commercial standpoi are: (1) that bottle infection can be eliminated; (2) that milk losses are save owing to evaporation over the cooler; (3) that ordinary cardboard caps c be used. The principal disadvantage is that the air-cooling process requi several hours. This, however, would be a disadvantage only in the few plan where milk is delivered directly after pasteurization.

1086 – **Studies on the Bacillus of Yoghurt.** — DUCHÁCÉK, F., in *Biochemische Z schrift*, Vol. 70, Nos. 3 and 4, pp. 269-293. Berlin, August 3, 1915.

Experiments made at the Pasteur Institute in Paris have shown th *Bacillus bulgaricus*, or the bacillus of Yoghurt, especially decomposes la tose and other simple sugars (glucose, galactose, mannose, etc), while no of the fatty matter in milk and only a very small quantity of the albumi is affected by it. These results were accepted until a few years ago, wh Effront claimed to have proved experimentally that the Yoghurt bacill is not a sugar decomposing ferment, but a bacillus that especially ferme casein.

The writer has carried out comparative experiments with the Yoghu bacillus as described by the workers at the Pasteur Institute and with t bacillus as described by Effront. The first type was received directly fr Metschnikoff, while the second was sent to the writer by Effront. T writer called the first *bacillus B.* (*Bacillus bulgaricus*) and the secon *bacillus E.* (Effront's *bacillus*).

Experiment has shown that there is already a difference betwe these two types as regards the choice of the medium in which th develop. *Bacillus E.* develops exceedingly well in all the usual med while *bacillus B.* is very exacting in this respect. The latter does n grow in media without sugar, even if their composition is normal. the other hand, *bacillus E.* does not require sugar for its developme *Bacillus B.* is also very exacting as to the kind of sugar; it prefers gluco galactose and lactose, but will not tolerate maltose and saccharose.

In addition to a particular kind of sugar, *bacillus B.* also requires, es cially in artificial media, the addition of carbonate of lime for the neut lisation of the acid. The writer has, in fact, proved that lime is absolut

dispensable to its normal development. On the other hand, *bacillus E.* rows very well without lime.

A 3rd characteristic distinguishing the two types of bacteria is their ehaviour as regards air. While *bacillus B.*, can grow in an anaereobic edium, *bacillus E.* is distinctly aerobic.

There is also a difference in their fermentation products. Both types ansform milk sugar into lactic acid but this acid behaves very differently the polarimeter. *Bacillus E.* gives an inactive acid composed of levo- yrous and dextrogyrous lactic acid, (in equal parts) while the second only roduces dextrogyrous acid. Milk sugar is more quickly fermented by *acillus B.* than by *bacillus E.*

The two bacteria are finally distinguished by difference in the length f life; while *bacillus B.* dies after 3 months, *bacillus E.* can live for 3 years.

The writer finally endeavoured to determine whether *bacillus B.* could ecome converted into a type with the special property of decomposing pro- ein as claimed by Effront. Another experiment was carried out to see hether the two types could change into one another. The results hroughout were negative.

o87 – **The Proportion of Live to Dead Weight of Cattle.** — TOMHAVE, W. H., in *The Country Gentleman*, Vol. LXXX, No. 32, pp. 1260 and 1274, 2 figs. Philadelphia, August 7 1915.

The carcass yield of animals varies according to their age, size, condi- ion, form and degree of finish etc., from 40 to 68 per cent of live weight in he case of cattle ; 40 to 65 per cent for sheep ; 70 to 88 per cent for pigs and o to 70 per cent for calves. The common supply of cattle will average about 5 per cent, sheep about 50 per cent and swine from 75 to 80 per cent.

Cattle — The fatter the animal, the higher will be the carcass yield, ut the amount of fat present should not mean an excessive amount f waste when the carcass is sold in the retail market. The dressing per- entage is an important factor in determining the price received for the nimal on foot. Frequently the animal that is purchased at the lowest gure is the most expensive when slaughtered and cut up. The slaughtering ata that were kept on two loads of cattle purchased by a Pittsburgh packing ompany illustrate this fact.

One load of very common steers averaged 1101 lbs. in weight ; they were urchased at $ 6.97 per cwt. These cattle were in an unfinished condition nd not of the desirable beef type. The load of good cattle averaged 949 lbs. nd fetched $ 7.70 per cwt. It was made up of well-bred beef steers that ad been properly fed. The load of common cattle dressed 50.80 per cent hile the better cattle dressed 58.15 per cent. The net cost of the dressed rcasses of the better cattle was $ 11.30 per cwt, while those of the poorer ttle cost $ 11.89 per cwt. Thus, in this instance, it was more profitable pay a higher price for the superior animals than to purchase an apparently heap load of cattle.

The packing company purchased two show steers from the Penn- lvania State College, they weighed 1860 lbs. and 1740 lbs. respectively nd sold for $ 9 per cwt. on foot. The yields were 67.20 per cent and

68.39 per cent, making their net cost of carcass, after allowing for the by products obtained, $ 11.95 and $ 12.10 per cwt. The higher dressing yiel and better condition made the net cost of the seemingly much highe priced cattle very little higher than that of the poor load purchased a $ 2.03 per cwt. less on foot.

Table I illustrates what becomes of the loss in dressing a steer weigh ing 1200 lbs. and in good condition of flesh.

TABLE I. — *Dressing Losses in Steer weighing 1200 lbs.*

Part	Weight, lbs.	Per cent. of live weight
Head	32	2.16
Feet	19	1.58
Pluck	26	2.17
Liver	13	1.08
Tongue	3	0.25
Tail	1.4	0.12
Intestines and contents	36	3.00
Blood and paunch contents	225	18.75
Paunch	32	2.66
Paunch and intestinal fat	28	2.33
Hide	75	6.25

A choice or prime carcass can be left hanging in the cooler for a longe time than the carcass of an inferior animal. A thin carcass will lose more in weight than a well finished one, owing to the greater evaporation The loss in weight from warm to cold weight will average from 1.5 to 2 per cent.

The value of a beef carcass depends upon its condition, form and per-centage of high-priced cuts. The relative percentages of weight and value on the market of the wholesale cuts of beef are illustrated by the following table :

TABLE II. — *Percentage of Value and Weight of Wholesale Beef Cuts to Carcass.*

Cuts	Average per cent. weight	Average per cent. value
Loin	17	33.06
Ribs	9	15.47
Round	23	19.67
Chuck	26	18.30
Plate	13	9.13
Flank	4	0.89
Front Shank	4	1.49
Suet	4	1.19

The figures in Table II give the reason why so much importance is ttached to well-developed ribs and loins and compactness of beef form.

Fat calves that have been fed on whole milk will dress from 55 to 60 er cent. Those fed on milk susbtitutes and skim milk usually dress rom 40 to 50 per cent.

Pigs. — While 10 years ago heavy pigs were in demand, the increase n the price of pork, the decreese in the demand for lard, the call for small oins, hams and shoulders have placed the medium weight pig, 175 to 250 bs., at the top of the list. The following table shows the percentages of lressed carcass that may be obtained from pigs of various weights now opular on the markets.

TABLE III.

Live Weight, lbs.	Dressed Weight, lbs.	Dressing Percentage
240	204.2	85.08
230	193.7	84.25
225	182.35	81.04
200	163.6	81.80
192	156.6	81.05
183	147.5	80.06

Sheep — The following table gives the carcass yield of wethers and ambs in different conditions as regards finish.

TABLE IV.

Wethers.

Breed	Condition	Live Weight, lbs.	Dressed Weight, lbs.	Dressing Percentage
outhdown	Very fat	187	111.6	59.67
hropshire	Fat	184	102	59.97
hropshire	Half fat	170	79	46.47
erino	Fat	151	74	49.00

Lambs.

orset	Half fat	104	49.5	47.59
erino	Thin	91	37	40.65

When the dressing percentage is very low the quality of the meat is also duced in proportion.

45 to 50 per cent is usually considered a fair yield for sheep and lamb carcasses, it is higher in meat producing animals than in wool-producing sheep. Lambs seldom dress much higher than 50 per cent. Heavy wethers frequently dress as high as 60 per cent, but a large proportion of the fat is waste and goes into the tallow basket.

1088 – **The Structure of the Wool of Pure-Bred Wool-Producing Sheep and that of Crosses with the Kemp-producing Race.** — GÜLDENPFENNING, H., in *Kühn-Archiv*, Vol. 6, Part. 1, pp. 84-92. Berlin, 1915.

The crossing of a wool producing breed with one producing kemp should, in all probability, give rise to individuals with fleeces consisting partly of kemp and partly of wool. This is what seems to happen in practice according to superficial observation. But exact figures are necessary if it is wished to determine how the characters are transmitted and the respective proportions of kemp and wool. In order to determine this with accuracy it is essential to have an accurate estimate of the numbers of each kind of fibres in a sample. The writer first freed a small sample from fat by treating it with ether and after allowing it to dry weighed it and picked and counted the fibres of kemp. The two masses of fibres were afterwards weighed and the number of wool fibres also determined. If accurate results are to be obtained it is absolutely necessary to proceed in this laborious manner.

The following table gives the results obtained. Its examination may cause some surprise that the Somali sheep, which belong to a kemp producing breed should possess such a relatively large quantity of wool fibres viz. 2 ½ times the number of the kemp fibres. When the animal is examined the wool is almost entirely concealed on account of the thinness of the fibres and their small mass — a fact which is confirmed by their weight.

On comparing the figures relating to the hybrids, it is seen that they show intermediate values in regard to all the points under consideration. The weight, as well as the numbers and diameter of the threads of the kemp and wool represent values intermediate between those of the Somali sheep and the wool-producing breed, The cross with the Electoral, however, forms an exception, as regards the weight of the kemp fibres. It is not yet known whether the Electoral breed becomes weakened in its progeny or whether the heterogeneous nature of the cross has had some effect upon the formation of the fibres of kemp. It is, however, surprising that this breed which has long been selected for fineness of wool, should when crossed with the coarsest wooled breed, the Somali, have a higher proportion of kemp by weight than the other races. If the number of kemp fibres is considered it is seen that the Somali sheep come first, and are followed by the hybrids in the following order: Rhön Electoral, Franconia, Dishley, Merinos, mutton-producing Merinos. Similarly with regard to the diameter of the kemp fibres.

Crossing with the Electoral breed is a case apart even as regards the degree of fineness of the kemp. The maximum fineness, both in kemp and wool, is obtained by crossing with mutton-producing merinos, the other

	Weight aad number of fibres	Percentages of		Proportion of kemp to wool
		kemp fibres	wool fibres	
Somali ram.	Weight . .	80.2	19.8	4 : 1
	Number . .	28.1	71.9	1 : 2,6
Somali × Electoral	Weight . .	44.35	55.65	1 : 1,3
	Number . .	17.41	82.59	1 : 4,7
Somali × Mutton-producing Merinos.	Weight . .	33.46	66.54	1 : 2
	Number . .	13.50	86.50	1 : 6,4
Somali × Merinos-Dishley	Weight . .	29.75	70.25	1 : 2,3
	Number . .	16.51	83.49	1 : 5,1
Somali × Franconia	Weight . .	41	59	1 : 1,4
	Number . .	17	83	1 : 4,9
Somali × Rhön	Weight . .	36.7	63.3	1 : 1,7
	Number . .	18.8	81.2	1 : 4,3

breeds follow in this order: Electoral, Dishley, Merinos, Franconia, Rhön. There is thus a connection between the coarse-ness of the kemp and that of the wool, just the reverse of what happens in the case of breeds with mixed wool, where as a rule, the coarser the kemp the finer is the wool. This is explained by the fact that in sheep with straight (not crimped) wool the fibres are much coarser than in the case of merinos, this character being transmitted hereditarily.

The results of the researches are summarised thus:

1) As regards fineness of wool, mutton-producing merinos are equal to the animals of the Electoral breed but their fleeces are twice as long. The Merino-Rambouillet and Merino-Dishley breeds have a fleece of the same length but their wool is coarser.

2) Among the straight wooled sheep, the East Frisian milk-producing breed, similarly to the Lincoln in the case of English sheep, constitutes a special type. The former is distinguished in its particular group by the small amount of crimp and the smooth appearance of its wool, while the wool of the Lincoln sheep is long and fine with a greasy lustre.

3) From the quality of their coat, the mixed wool and kemp producing breeds can form a group apart for which the rule may be formulated that the coarser the kemp the finer the wool.

The very fine wool of the Somali breed has lost its fineness through crossing with other breeds.

4) The determination of the proportion between the weight and the respective numbers of the kemp fibres and of wool fibres, is of great im-

portance. When determined, it was seen in the offspring of crosses to have an intermediate value.

5) The consistency of the kemp fibres of wool varies considerably in different breeds and between one animal and another. The wool of merino sheep has an average extensibility and a more uniform, and perhaps greater resistance to strain than that of any other breed. The products of crossing give, even in this case, intermediate values.

6) The elasticity coefficients of the wool of merinos and their hybrids are approximately equal. The highest average coefficient is that of the smooth and the mixed wool breeds.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1089 - **Effects of Illuminating Gas on the Root-System.** — HARVEY, E. M., and ROSE, R. CATLIN, in *The Botanical Gazette*, Vol. LX, No. 1, pp. 27-44, figs. 1-9. Chicago, Ill., July 1915.

The writers give a brief summary of the results obtained by KNY, SPÄTH and MEYER, BÖHM, MOLISCH, SHONNARD, RICHARDS and MC DOUGAL, and Stone on this subject. Their own researches carried out in the Hull Botanical Laboratory were designed with the object: 1) of determining some of the effects of illuminating gas on the root-system with a view to obtaining further diagnostic characters indicating gas poisoning; 2) of determining if the principle causes of the damage are the constituents of the gas which are readily absorbed by the water film of the soil particles, or those which remain mainly in the soil interstices.

The gas used was the so-called "water gas" prepared by the method of the "Chicago Gas Light and Coke Company"; it contained 2 to 6 per cent of ethylene. As it has been shown that ethylene is the most toxic constituent of illuminating gas, comparative experiments were carried out with a mixture of air and 4 per cent by volume of ethylene.

The toxicity of the constituents of illuminating gas absorbed by the soil. — Soil of optimum humidity was placed in 10-20 liter cans and the gas passed through for different periods ranging from 53 to 68 days and at different temperatures. After exposure to the air the soils were removed from the cans, placed in shallow boxes in a greenhouse, and sown with the seeds of 41 species of plants belonging to 18 families. From 25 to 60 days were allowed for growth.

Effect of illuminating gas on roots with no soil present. — In the neck of a large wide-mouthed bottle, serving as a moist-air chamber, 6 to 8 glass tubes were inserted, each carrying a seedling of *Vicia faba* so that the roots hung inside the chamber. Definite amounts of illuminating gas or ethyl-

ene were admitted through a small glass tube reaching to the bottom of the bottle. In this way only the roots of the plants were exposed to the gas. A similar series of bell jars was arranged for seedlings of tomato, radish and mustard.

Effect of illuminating gas on roots growing in soil medium. — 1) Quantitative experiments. — Plants of *Catalpa speciosa, Ailanthus glandulosa* and *Gleditschia triacanthos,* from 2 to 3 months old, were transplanted to large battery jars filled with coarse quartz sand. The gas was passed through two glass tubes buried in the sand and sealed with a vaseline paraffin mixture by the method of BRIGGS and SHANTZ. By a previous determination of the total volume of the interstices in the sand it was possible to control the concentration of the gas. The experiments were continued for 5 to 21 days, the gas being renewed every three days, pure air being drawn through by means of an aspirator and new gas added. In several cases parallel experiments were carried out with ethylene.

2) Qualitative experiments. — An attempt was made to imitate the natural conditions of an escape of gas near the roots. Eleven species of woody plants were used and a comparative microscopic examination was made.

The results obtained are summarised as follows :

When illuminating gas is passed through soil the odor-giving constituents of the gas are readily absorbed by the soil particles and strongly held, but little or no toxic effect on the roots of plants is observed. The gas constituents remaining in the gaseous state in the soil are the principal causes of injury to the root-system. Of these constituents ethylene is perhaps the most injurious, except in high concentrations of the gas, when other toxic substances and factors come into play.

A low concentration of gas causes an abnormal development of the tissues in from 8 to 21 days with seedling trees, using illuminating gas mixed with 4 parts of air (of the soil) or even with 40 parts of air. Similar effects are produced by ethylene at similar concentrations to those of the gas mixture.

A high concentration of gas causes a rapid killing of the roots shown by the death of the whole plant.

If the gas is passed through the soil very slowly, in the case of woody plants an abnormal development of the root tissues often occurs. At low concentrations illuminating gas stimulates the hydrolysis o starch and other allied chemical changes.

It was observed that etiolated sweet pea seedlings are very sensitive to the effects of gas and indicate its presence in the soil when it is not perceptible by ordinary methods.

1090 – **Scorching of Tobacco Leaves by Paris Green.** — DE BUSSY, L. P., and DIETZ, P. A., in *Mededeelingen van het Deli Proefstation te Medan,* Year IX, Part 1, pp. 15-25. Medan, Sumatra, June 1915.

The use of Paris green (aceto-arsenite of copper) as an insecticide is often the cause of scorching of the leaves of tobacco. This can be avoided by substituting arsenate of lead, which never injures tobacco. The writers' experiments show that if Paris green is preferred it should be used in such

a strength as not to contain more than 0.4 per cent of water-soluble arsenate. It should be applied mixed with a neutral substance such as tapioca or very fine soil. A flour that has become acid or substances containing large particles should not be used. The mixture should be perfectly homogeneous and the application made when the leaves are quite dry.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

1091 – **Causes of Damage to Apple Crops in the United States.** — *The Country Gentleman*, Vol. LXXX, No. 31, p. 1237. Philadelphia, July 31, 1915.

The accompanying tables contain the results of an investigation carried out by the Federal Bureau of Crop Estimates on the factors influencing apple yields. The figures emphasize the necessity for supplementary irrigation, for protection against frost by smudging and for the production of apples that are hardy and bloom late enough to escape the frosts.

TABLE I. — *Percentage losses in apple orchards in the United States from various causes.*

Cause	1914	1913	1912
Deficient moisture	22	18	10
Frost or freeze	21	47	29
Other climatic disturbances	8	8	14
Total climatic causes	51	73	53
Plant diseases	6	3	15
Insects	20	9	10
Other or unknown	23	15	22
Total	100	100	100
Production, per cent of normal crop	74.5	44.6	69.9

TABLE II. — *Percentage losses in Apple States.*

	New York	Pennsylvania	Virginia	Michigan	Missouri	Washington
Deficient moisture	14	16	35	7	51	18
Frost or freeze	18	25	18	12	13	40
Other climatic disturbances	7	9	8	10	5	10
Total climatic causes	39	50	61	29	69	68
Plant diseases	1	7	3	23	2	8
Insects	38	14	9	20	15	16
Other or unknown	22	29	27	28	14	8
Total	100	100	100	100	100	100
Production, per cent of normal crop	84	88	86	82	54	89

1092 - **Researches on *Coniothyrium pirinum, Phyllosticta pirina* and *C. tirolense.*** — MUTTO, ELISA, and POLLACCI, GINO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 1915, 2nd Half-Year, Vol. XXIV, Part 1, pp. 40-42. Rome, August 6, 1915.

In 1878 P. A. SACCARDO described *Phyllosticta pirina* as a new species on the leaves of *Pyrus communis* and *P. malus*. In 1904, BUBAK discovered on the leaves of *P. communis* a species of *Coniothyrium* which he named *C. tirolense*. J. L. SHELDON, in 1907, after examining numerous specimens of *P. pirina* on the leaves of apple and quince, stated that the stylospores of the ripest pycnidia are decidedly brown in colour, the intensity being in direct relation to the degree of maturity. Without comparing specimens of the two fungi he considered that *C. tirolense* might be a form of *P. pirina* in a ripe condition and consequently changed *P. pirina* to *Coniothyrium pirinum* (Sacc.) Sheldon (1).

In 1908 C. P. HASTLEY, examining preparations of *C. tirolense*, considered this species to be identical with *C. pirinum*. The writers have now compared cultures of *P. pirina* and *C. pirinum* with material of *C. tirolense*, and have found that the influence of the various cultures used (decoction of apple leaves, potato, glucose agar, beet and carrot) is confined to the dimensions and does not affect the colour of the stylospores of *C. pirinum* and *P. pirina*. In the first stages of their development the stylospores of *C. pirinum* are hyaline like those of *P. pirina*, so there is a danger of error in the distinction of these two species. The stylospores of *P. pirina* remain constantly hyaline in the various cultural media employed.

(1) Written by him *C. pirina*.

even up to complete developement, whilst in the same media *C. pirinum* produces coloured stylospores. *Phyllosticta pirina* is therefore not synonymous with *Coniothyrium pirinum*, but a quite distinct species.

The species *C. pirinum* of Sheldon has characters absolutely agreeing with those of *C. tirolense* and cannot be accepted as distinct but should be considered according to priority as a synonym of *C. tirolense*.

1093 – **Observations on *Herpotrichia nigra* and the *Mytilidion* associated with it** (1). — SEAVER, FRED J. (New York Botanical Garden), in *Mycologia*, Vol. VII, No. 4, pp. 210-211. Lancaster, Pa., July 1915.

Several years ago while attempting to work out the identity of *Herpotrichia nigra* Hartig and *Neopeckia coulteri* (Peck) Sacc., the writer was surprised to find the ascospores of a third species on *Picea*, which was at first thought to be an undescribed species of *Herpotrichia*. The spores of this species were fusiform, long and narrower than those of *H. nigra*, and, while usually 5-septate, they were often 6-septate and occasionally even 7-septate, while those of *H. nigra* were broad, blunt and never more than 3-septate so far as observed. This strange species was first detected while studying ELLIS and EVERHART'S *Fungi Columbiani* 1737, a specimen of *Herpotrichia nigra* which was erroneously distributed under the name of *Lasiosphaeria coulteri*. The spores of this species were again observed while examining a specimen of *H. nigra* on *Picea engelmanni* sent from Colorado by BETHEL, July 7, 1914.

After a careful study it was found that these fusiform spores were not the spores of a *Herpotrichia*, but those of a *Mytilidion* (Hysteriales) often found on conifers associated with *H. nigra*. The perithecia are so intimately associated with those of the *Herpotrichia* that their real characters may be easily overlooked and the spores of the *Mytilidion* may be mistaken for the mature spores of the *Herpotrichia*.

This species of *Mytilidion* is closely related to, if not identical with, *M. fusisporum* (Cooke) Sacc., reported on branches and bark of spruces and firs. The spores of *M. fusisporum* are 50 μ long, while those of this *Mytilidion* never exceed 40 μ and are often not more than 30 μ. Without having seen an authentic specimen of *M. fusisporum*, the writer can only doubtfully refer his specimens to that species.

The recent description of a new species of *Herpotrichia* (*H. quinqueseptata*) by WEIR (2) attracted the attention of the writer, since the spores of his species are practically identical in size and form with those of the *Mytilidion* so frequently found with *H. nigra*. The writer believes that WEIR'S supposed new species is based on the combined characters of two different fungi, the mycelial and perithecial characters being those of the well-known *Herpotrichia nigra*, while the ascus and spore characters are those of the *Mytilidion*. This suspicion has been strengthened by recent studies of the collections of *H. nigra* in the New York Botanical Garden, from which it appeared that practically every specimen of *H. nigra* examined was accom-

(1) See also *B.* Sept 1915, No. 986. (*Ed.*).

(2) *loc. cit*

panied by the *Mytilidion*. The latter was found not only on spruce needles associated with *Herpotrichia*, but also on pine needles associated in the same way with *Neopeckia coulteri*.

WEIR's drawings illustrate very well the spore characters of *N. coulteri*, *H. nigra* and the unnamed species of *Mytilidion*, except that the spores of the last are not always 5-septate, but often 6 and occasionally even 7-septate. The spore measurements are usually within the limits given by WEIR, but spores are occasionally found as long as 38-40 μ. They are of a pale brown colour as described by the same writer.

RESISTANT PLANTS

1094 – **Influence of Radio-active Substances on the Resistance of Plants to Fungus Diseases.** — See above, No. 1015.

MEANS OF PREVENTION AND CONTROL

1095 – **Preventive Measures against Bunt in Wheat.** — DARNELL-SMITH, G. P., in *The Agricultural Gazette of New South Wales*, Vol. XXVI, Part 6, pp. 494-495. Sydney, 1915.

During 1914 the Department of Agriculture of New South Wales carried out a further series of experiments to determine the most suitable fungicide to apply to wheat seed to prevent infection with bunt (*Tilletia*).

Unfortunately, at both the Cowra and Wagga stations, the season was so unfavourable that the results of the field trials have to be taken with a certain amount of reserve ; the germination was bad, and many plants perished before reaching maturity.

Some experiments on germination in nursery boxes made at Cowra showed remarkable consistency, as seen in Table I.

TABLE I. — *Results of various treatments on Federation seed-wheat.*

Box No.	Treatment	Number of seeds sown	Number of seeds germinated
1	½ per cent copper sulphate and limewater . . .	50	45
2	» » » » without » » . . .	50	43
3	1 » » » and » » . . .	50	50
4	» » » » without » » . . .	50	47
5	1½ » » » and » » . . .	50	45
6	» » » » without » » . . .	50	41
7	2 » » » and » » . . .	50	46
8	» » » » without » » . . .	50	36

In each case the seed was kept in the solution for three minutes. Treatment with sulphate of copper alone gives a satisfactory germination under favourable conditions, but not so if conditions are unsatisfactory. Under the most favourable conditions the use of copper sulphate followed by lime water was advantageous in all cases.

Dipping wheat seed for three minutes in a 1½ per cent solution of copper lphate, followed by dipping for three minutes in limewater, has up to the esent been found the most effective pickle for preserving the germinating pacity and preventing bunt infection.

The 1914 season at Wagga was the worst ever recorded in the district. ıe total rainfall from sowing to harvest was only 3.45 inches, and probably this account the results of the field trials (see Table II) were somewhat consistent. The number of growing plants was determined on August , and the observation as to bunt infection was made on October 10 and 15. nearly every row odd plants were missing.

TABLE II. — *Results of treatment for bunt.*

Treatment	Variety Bunyip			Variety Comeback		
	No. of seeds germinated	Bunty plants	Clean plants	No. of seeds germinated	Bunty plants	Clean plants
pper sulphate (½ %) and limewater	89	1	88	80	5	75
» » » without »	90	1	77	83	10	71
pper sulphate (1 %) and limewater	75	0	75	84	0	81
» » » without »	57	0	57	81	0	80
pper sulphate (1½ %) and limewater	72	0	70	65	3	61
» » » without »	66	0	65	69	1	67
per sulphate (2 %) and limewater	70	0	68	76	1	72
» » » without »	73	0	67	68	1	65

The number of seeds planted was 100 in each case and the time of im- rsion in copper sulphate and limewater was three minutes.

DISEASES OF VARIOUS CROPS

) – ***Sclerospora macrospora*** **on Wheat in France.** — ARNAUD, G., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 14, pp. 429-435, figs. 1-2. Paris, July 7, 1915.

On June 16, 1915, the Plant Disease Station of Paris received from Chas- ard, Allier, some specimens of bearded wheat attacked by *Sclerospora rospora* Sacc. (Peronosporaceae). This is the first record of the fungus rance.

In Italy, where it was at first confused with *S. graminicola* (Sacc.)

Schröter, it has been known since 1900 (1), and has occurred in vario parts of the peninsula and in Sardinia. In Italy it attacks wheat in par cular, but also oats, maize, canary-seed (*Phalaris canariensis*) and vario wild grasses (*Phragmites communis*, etc.) (2). According to TRAVERS the same species has been described on *Phalaris arundinacea* in Saxo under the name of *S. kriegeriana* Magnus (3).

The specimens repoited showed the last stage of the disease, confin to the leaves; but the awns of the ears showed some contortion. An a count is given of the observations of PEGLION and TRAVERSO on this disease (

1097 - **Yellow Rust of Cereals *(Puccinia glumarum)* discovered in No America.** — CARLETON, M. A., in *Science*, New Series, Vol. XLII, No. 1071, pp. 58- Lancaster, Pa., July 9, 1915.

On May 21, 1915, *Puccinia glumarum* Eriks. et Henn, was discovered several varieties of wheat in a field situated near Indian School, Sacato Arizona. About the same time it was also found on *Hordeum murinum* Southern California. So far this rust has not been recorded on whe in any part of California, but during June it was found in abundance various parts of Oregon and Washington, fairly widely spread in Idaho a represented by a few examples at Bozeman, Montana, and Logan, Uta

Up to July 1, *P. glumarum* had not been found in any place east of t Rocky Mountains. In Oregon and Washington State it was observed a on barley, and at Pullman, Washington, the writer has found it on a w grass not yet determined.

It is remarkable that this fungus, so common in Europe, had not be previously recorded in North America, in spite of the constant trade re tions between the two continents.

(1) The disease was observed as early as 1873; cf. TRAVERSO, G. B., in *Il Raccoglit* New Series, Vol. IV, pp. 182-188 (Padua, 1906). (*Ed.*).

(2) Also barley; see *B.* Jan. 1911, No. 296 (SEVERINI). (*Ed.*).

(3) PEGLION (*Le malattie crittogamiche delle piante coltivate*, 3rd. ed., p. 121, Casale, 19 refers to it as very injurious to rice-fields in Japan. — STEVENS, F. J., and HALL, J. G. (*Disc of Economic Plants*, p. 342, New York, 1910), mention it as occurring on maize in the Uni States, but doing little damage. (*Ed.*).

(4) The chief Italian literature is as follows: PEGLION, V., in *Bollettino di notizie agr* No. 20, 7 pp. (Rome, 1900); *Annuario della R. Stazione di Patologia vegetale*, I, p. 81 (Rome, 19 *Le Staz. sper. agr. ital.*, Vol. XXXIV, 31 pp. (Modena, 1901); *Rend. Accad. Lincei, cl.* Series V, Vol. XI, pp. 389-392 (Rome, 1902); *Italia agricola*, Vol. XXXIX (Piacenza, 19 *Atti Accad. Sc. med. e nat. di Ferrara*, LXXXII, pp. 137-138 (Ferrara, 1908); *Rend. Acc Lincei*, XXVII, Part 9, pp. 509-511 (Rome, 1908); *Centralbl. Bakter., Abt. II*, XXV pp. 580-589 (Jena, 1910). — TRAVERSO, G. B., in *Malpighia*, Vol. XVI, 11 pp (Genova, 19 *Le Staz. sper. agr. ital.*, Vol. XXXV, pp. 46-49 (Modena, 1902); *Ibid.*, Vol. XXX pp. 975-976 (Modena, 1904); *Il Coltivatore*, LX, 2, pp. 523-524 (Casale Monferrato, 1914) GAROVAGLIO, S., in *Archiv. Lab. Bot. Critt. di Pavia*, Vol. I, pp. 132-133 (Milano, 1871) CUBONI, G., in *Rend. Acc. Lincei, cl. Sc.*, Series V, Vol. XIII, pp. 545-547 (Rome, 19 (*Ed.*).

1098 – ***Monilia* sp. causing Brown-Rot of Apricots in the Lower Rhone Valley.** — CHIFFLOT, J., and MASSONNAT, in *Revue Horticole*, Year 87 (1914-1915), No. 27, pp. 540-541. Paris, August 16, 1915.

At the beginning of May 1915 the attention of the writers was called to a serious disease of apricots planted on the slopes overlooking the Rhone Valley on the east, upstream from Vienne, Isère.

The disease affects standard trees just after flowering. The flowers wither quickly without falling; then the withering extends to the neighbouring leaves and twigs. An abundant gummosis later invades the parts affected and sometimes extends to the lateral twigs and buds, from the summit towards the base. As a result of this gummosis the tissues of the twigs become swollen ; the woody part separates completely from the bark and cortex ; the wood becomes brown and later black. The flow of sap is stopped, thus causing death of the twigs.

This disease is indigenous in many districts. According to FAES it caused considerable damage during 1903, 1913 and 1914 in large orchards in the Canton of Valais (Switzerland), particularly at Saxon, after rainy spells in the spring. The writers know of no previous appearance of this disease in the French part of the Rhone valley.

By some authorities it is attributed to *Monilia cinerea* Bon. and by others to *M. laxa* (Wallr.) Sacc. et Vogl. These two species also attack the fruits of peach, cherry, apple, pear, plum, apricot, etc., which become mummified.

Unfortunately these infected fruits are too often left on the trees, thus forming centres of infection. They should be collected and burnt — not buried — before the conidia are dispersed. The numerous spores discharged from the fungus fall on the twigs and young shoots or are carried away by the wind, germinating readily in the following spring.

The flowers form the first point of attack, and are apparently infected through the stigmas ; thence the disease rapidly spreads in the juicy tissues of the young twigs. The less vigorous trees producing few flowers are less severely attacked, while heavily manured nursery trees producing vigorous shoots are most severely attacked.

For the control of the disease the following treatments are recommended:

a) *Winter.* — Removal and burning of dead branches ; spraying abundantly the trunk, branches and twigs, either by means of the usual copper sprays (Bordeaux or Burgundy) or by neutral copper acetate at 12 lbs. per 100 gallons, with the addition of 10 gallons of gelatine solution or else of soft soap solution (20 lbs. of soap to 100 gallons of copper mixture). The modified copper sprays are the wetting sprays of VERMOREL and DANTONY. Copper sprays at a temperature of 70° C. (158° F.) may also be used, provided that the acetate solution does not exceed 1 per cent. These winter treatments are " preventive ".

b) *Spring.* — No copper treatment is possible owing to the danger to the foliage. The damaged parts are removed and burnt ; cutting back must be effected very low, below the diseased parts, so as to suppress as

far as possible all trace of gummosis and mycelium in the interior of the tissues of the twigs.

c) *General.* — Excessive nitrogenous manuring must be avoided and chemical manures rich in phosphates and potash applied.

1099 - ***Zignoella garciniae* injuring Mangosteens (*Garcinia mangostana*) in the Federated Malay States.** — BELGRAVE, W. N. C., in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 6-7, p. 229. Singapore, 1915.

In the Federated Malay States, the mangosteen is subject to the attack of *Zignoella garciniae* P. Henn., which determines the formation of cankers in the woody parts of trees, spreading from the younger to the older branches. When the cankers encircle the branches the leaves turn brown, shrivel up and die and soon the whole tree perishes.

Examination of the transverse section shows that the cankers extend to the interior towards the wood, which, however, is itself rarely attacked. In the infected bark two or three layers of cork are found, showing the efforts of the plant to resist the fungus; below the deepest of these layers is a zone of soft tissue without latex constituting the cork cambium.

Mycelium is abundant in the bark, where also the fruit bodies (perithecia) occur. In the cankers are often found the pycindia of a species of *Hendersonia*, which is probably a phase of development of the *Zignoella*.

Without careful inspection of the trees it is not easy to recognise the existence of the disease before the leaves turn yellow, when the death of the tree is a certainty. On the appearance of the disease, the only means of treatment is felling and burning of all diseased trees, followed by careful examination for cankers and their removal.

1100 - **Observations on the Pathology of the Jack Pine *(Pinus divaricata)*.** — WEIR, JAMES R. (Forest Pathologist, Office of Investigations in Forest Pathology), in *Bulletin of the U. S. Department of Agriculture*, No. 212, 10 pp., 4 figs., 1 plate. Washington, 1915.

Pathologically the jack-pine [*Pinus divaricata* (Ait.) Du Mont. de Cours.] may be divided, in most regions of its range, into two forest types, which are determined largely by the amount of moisture in the soil. The fungi in the moist or swamp type may attack the trees in the drier and more arid type, but may show considerable variation in the abundance of any one species. In mixture with other species it is usually attacked by a greater number of diseases than in pure stands.

Parasitic fungi. — According to observations in Michigan and Minnesota, the greatest immediate injury is caused by *Peridermium cerebrum* Peck (*Cronartium quercus* [Brondeau] Schröt.), which causes gall-like excrescences on the trunk and branches. In dry, sandy areas *P. cerebrum* is more frequent on the branches and is rare on the trunk, but also frequent in the axils of the branches; the damage is generally more serious in the latter case than in the two former. The branch and trunk are girdled by abnormal wood tissues and are thus weakened. Whatever the means of infection, direct or through wounds, the number of galls and imperfect branches is usually much less on trees of the sandy barrens than in more moist regions.

In swampy areas (where the jack pine grows in close stands) the trunks of the 6 to 12 year old trees are often covered with swellings which very rapidly stunt the growth of the trees ; such trees never reach maturity, but continue in a stunted condition until blown over by the wind or broken down by snow. Often seedlings of 1 to 4 years are attacked. In these cases, as well as in older trees infected through mechanical injury at the ground, the gall is formed directly at the base of the main stem. When a seedling is infected at this point or higher up on the stem, it remains short and deformed. The cones of infected trees are small and give a higher proportion of aborted sporophylls than usual. Seeds from infected trees and vigorous non-infected trees of the same age and type showed a difference in germination of 19 per cent in favour of the latter.

The prolific development of *Peridermium cerebrum* in many parts of the jack-pine forests of the Great Lakes region is a factor to be carefully considered in reforestation. The fact that the fungus has its telial stage on the leaves of several species of *Quercus* is also of significance in control work. *Q. velutina* and *Q. coccinea* frequently form a conspicuous part of the jack-pine type, particularly in Michigan. The eradication of these worthless species could be undertakem in small wood lots.

In this region, a few young jack-pines were found to be attacked by *Peridermium comptoniae* (Arthur) Orton et Adams (*Cronartium comptoniae* Arthur), but this fungus was not found on more mature growth. Its alternate stage is on sweet fern (*Comptonia peregrina* and *Myrica gale*). It can not reproduce itself on jack-pine.

These hosts, as well as oaks, must therefore be destroyed in the neighbourhood of nurseries. Much attention should also be given to the selection of nursery sites, with regard to the topography and prevailing winds.

With the exception of *P. cerebrum* and *P. comptoniae*, few fungi of economic importance attack the living jack-pine in the drier parts of its range. In mixture with other species in the more moist regions, particularly in parts of northern Minnesota and of Canada, *Trametes pini* (Brot.) Fr. causes considerable heart-rot in trees of 60 years and older, but in general occurs in negligible quantities.

Polyporus schweinitzii Fr., causing butt rot, is in greater quantity, but seldom attacks more than 2 to 4 per cent of the stand. Root fungi (*Fomes annosum* Fr. and *Armillaria mellea* (Vahl.) Quél.) are rare.

Lophodermium pinastri Schrad. is found occasionally on the needles.

On dry soils in open stands the jack-pine frequently shows a tendency to form witches'-brooms.

In its eastern range *P. divaricata* is not subject to mistletoe injury ; but *Razoumofskya americana* (Nutt.) Kuntze, the lodgepole-pine mistletoe, has been recorded on it in Canada. The writer finds this mistletoe to be the cause of serious damage to the jack-pine at its most western extension or where it approaches the zone of the lodgepole pine (*P. contorta*) in the north.

Saprophytic fungi. — The usual strictly saprophytic fungi of coniferous woods are found on cut or fire-killed jack-pine. *Ceratostomella pilifera* Fr.

appears rapidly after the death of the tree. In moist places there is also an abundance of species of *Auricularia* and *Dacryomyces* of little importance. The most important of these saprophytes is *Polystictus abietinus* Dicks.; second comes *Lenzites sepiaria* Fr. Of little importance and rare are *Fomes pinicola* Fr., *Polyporus palustris* Berk. et Curt., *F. cameus* Nees, *Lentinus lepideus* Fr., *Polyporus sulphureus* Fr., and *Trametes sepium*. On fallen specimens in Minnesota is occasionally found *Poria subacida* Peck, which is probably also parasitic on the living trees. Amongst the Thelephoraceae the following are important: *Corticium byssinum* (Karst.) Burt., *C. sulphureum* Pers., *C. galactinum* (Fr.) Burt., *Coniophora olivacea* (Fr.) Bres., and *Peniophora globifera* E. et E.

Injuries due to other causes. — Jack-pine is very sensitive to fire. It only occasionally suffers from winter injury, and is very windfirm.

Since this tree is comparatively free from a number of diseases which are common on other conifers and is resistant to drought, winter injury and frost, it is admirably suited for reforesting many of the dry sandy regions of the North-Central States.

WEEDS AND PARASITIC FLOWERING PLANTS.

1101 – **The Cutting of Weeds in Rice Fields.** — MARCARELLI, B., in *Il Giornale di Risicoltura*, Year V, No. 15, pp. 248-249. Vercelli, August 15, 1915.

The most injurious rice-field weeds are those which not only spring up with the rice, but also grow on the levees of the fields, along the canals, and in meadows on moist ground; among these are certain grasses, in particular *Panicum crus-galli* and *P. phylloryzoide* (1), which are capable of tillering in an extraordinary manner and consequently produce seeds in large numbers. Repeated and careful weeding is not sufficient do destroy these weeds. A good preparation of the land, the use of well decomposed manure and of seed free from foreign seeds are very good measures, but it is only by hand-weeding or the use of special instruments for removing the weeds growing among the rice after the ordinary weeding, and especially by mowing them on all the parts of the field not under water, that the first and most important cause of the spread of weeds is removed; such work must be carried out before flowering and several times during the entire period of cultivation, as the perpetuation of almost all the injurious species depends not only on the enormous number of seeds and vegetative means of reproduction, but also on the successive ripening of the different seeds on the same plant. Sometimes even digging over of the levees is recommended, but this operation is too costly and injures their solidity.

If the cutting has not been effected at a suitable time and most of the weeds have ripening seeds, they should be cut and burnt without delay.

(1) See *B.* Dec. 1912, No. 1688. (*Ed.*).

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

1102 – **_Cladosporium_ sp. in the Control of the Citrus Scale, _Chrysomphalus dictyospermi_ var. _pinnulifera_, in Calabria** (1). — MOTTAREALE, G., in *Atti del R. Istituto d'Incoràggiamento di Napoli*, 1914, Series VI, Vol. LXVI, pp. 27-31. Naples, 1915.

Chrysomphalus dictyospermi var. *pinnulifera* after spreading from the citrus plantations of Sicily to those of the province of Reggio Calabria, has soon covered large areas, damaging not only the crop of fruit (especially bergamots) but also the green twigs and leaves.

The local growers deal effectively with this scale by washing with lime-sulphur. The agricultural adviser for the province of Reggio has carried out successful experiments with hydrocyanic acid fumigation at Pellaro.

In 1913, when the weather conditions allowed this scale to go on breeding even in November, the writer was informed that in the Lazzaro territory the activity of the insect appeared to be diminished, as even where the known means of control had not been applied the plants had regained their vigour.

Observations on the spot showed that this phenomenon was not confined to Lazzaro. Most of the insects, still remaining in numbers on the leaves, had the scutum flattened and of a greyish colour. On raising the scutum, the insect sometimes appeared to have lost its normal turgescence ; the pygidium was elongated and of a deep yellow colour tending towards chestnut. But more often the insect below the scale was reduced to a thin membrane, hardly adhering to the scale and easily detached.

Microscopic examination showed the presence of a *Cladosporium*, sometimes with hyaline hyphae confined to the interior of the insect, sometimes with luxuriant fructifications outside. No other fungi and no bacteria were observed, and the presence of all animal pests, either predatory or endophagous, is excluded.

Wherever plants show the presence of fumago independently of the insect, the latter is checked in its development and ravages.

The writer hopes to make experiments on artificial infection, but recommends meanwhile the continuation of chemical means of control, without neglecting to try the effect of insect enemies of the scale.

1103 – **The Action of Potassium Cyanide when introduced into the Tissues of a Plant.** — MOORE, W., and RUGGLES, A. G. (Minnesota Experiment Station), in *Science*, Vol. XLII, No. 1070, pp. 33-36. Lancaster, Pa., July 2, 1915.

The injection of potassium cyanide into plant tissues has recently been recommended for the destruction of various sucking insects (2). These experiments were devised with a view to determining the mode of action of the cyanide in the plant tissues.

The first attempts were made with geraniums. A small piece of cyanide about the size of a pea was placed in the stem and the hole sealed up with a

(1) See also *B.* April 1915, No. 451. (*Ed.*).
(2) See also *B.* Feb. 1915, No. 235. (*Ed.*).

piece of rubber and paraffin wax. On examining the plant 24 hours later the presence of cyanide could only be detected by smell. Sections of the stem were subjected to the prussian blue test and cyanide was found to occur only in the outer cortical layer and in the inner pith cells. The range of positive tests was about one foot above the wound and about 1½ inches below.

Other plants were treated for several days and it was found that whenever the cyanide reached the axil of a leaf, the petiole withered and died within a half inch of the base. Similar results were obtained whenever the cyanide reached a succulent offshoot. No tests for cyanide were obtained beyond the injured portion. Passing out from an older lateral branch, the cyanide seemed to show a preference for the upper side of the limb.

To account for the greater tendency of the cyanide to diffuse upwards it was suggested that the substance is decomposed by organic acids with the liberation of free hydrocyanic acid gas.

An experiment was therefore tried with the injection of a solution of hydrocyanic acid by means of a siphon tube. Examination of the tissues 24 hours later showed that the hydrocyanic acid was strongest in the vascular elements and also that diffusion took place downwards in the cellulose tissue, and at no particular point was the diffusion arrested as in the case of potassiun cyanide.

Potassium cyanide was then tried on an apple tree in March. After two days cyanide was only found in the lumen of the larger tracheae and the distance travelled was not more than two inches, which was indicated by a discoloration.

Further tests made later in April when the sap had increased showed that the cyanide diffused only through the woody tissue. No prussian blue test could be obtained in the bark or cambium layer.

A test was then made on a larger scale. A hole ¾ inch in diameter was bored near the base of a large apple tree, filled with cyanide, corked and sealed with collodion. Holes were bored above this at varying distances, about ½ inch in diameter and 1 ½ inches deep. These holes were fitted with glass tubes sealed at the outer end and containing distilled water. Thus a negative test for cyanide in these tubes would remove any hope of wood borers being destroyed by such means.

It was found that hydrocyanic acid had diffused upwards through an area from ½ inch to 1 inch in diameter to a height of about seven feet, but had missed the test holes, none of which gave the least trace of cyanide either by silver nitrate or prussian blue test. It follows therefore that the method would be useless unless applied locally to the borers.

It is possible that in certain plants the diffusion might be more extensive. In semi-woody plants, like the geranium, where the cyanide diffuses through the cortex, the method might be useful against sucking insects.

104 - **The Rice Leaf-Hopper (*Nephotettix bipunctatus* Fabr.) in India.** — Misra, C. S., 8 pp., 6 figs. Shalom Press, Nagpur.

The rice leaf-hopper, known to cultivators as "Maho", caused serious damage in 1914 to the paddy crop in the Raipur and Bilaspur Districts. It was first recorded in 1913, but as it appeared late the crop was not much damaged. The following year it appeared early and when the crop was nearly two months old it came in swarms and caused serious damage. The insect generally appears by the beginning of July in small numbers and deposits on the leaves its whitish eggs, flattened at one end and pointed at the other. By the beginning of September the plants swarm with it, and from 100 to 150 young may be counted on a single leaf.

In the larval stage the insects fix themselves to the midribs of the leaves and suck the sap. They exude a whitish sticky liquid which, falling on the leaves below, makes them sticky. The discolouration of the water in infested rice fields is probably due to this substance.

The plant attacked becomes a pale yellow colour and withers without producing any grain. The leaves covered with the sticky liquid are overgrown with a fungus which probably makes the straw uneatable later on. The adult hides itself under the leaves during the heat of the day and comes out to feed at dusk. It passes all its stages on the plant. The adult is most active from August to October and then becomes torpid from November to February. The number of adults which hibernate is, however, very small.

The best means of control are:

1. Where the pest has existed for two years in succession, early and hardy varieties such as Harhuna are recommended.
2. To bag the seed-beds with hand-nets before the seedlings are transplanted and to bag the broadcasted fields in July and August.
3. To set up light-traps on the field embankments.
4. If niether bags nor lamp-tramps are procurable, some good may be done by lighting fires on raised ground within the infested areas.
5. After harvest the fields should be grazed, especially along the paths where grasses grow.

To be effective these measures must be carried out by all the cultivators of a district.

105 - ***Hoplandrothrips affinis* n. sp. on Sugarcane in British Guiana.** — Hood, Douglas J., in *The Canadian Entomologist*, Vol. XLVII, No. 8, pp. 241-244, fig. 26. London, Ont., August 26, 1915.

A systematic description of a new thrips observed on sugarcane at Rose Hall, Berbice (British Guiana), March 2, 1915, by G. E. Bodkin.

It is the only species of the genus *Hoplandrothrips* yet recorded in South America.

1106 – **The Sugarcane Stalk-Borer (*Diatraea saccharalis*) in Porto Rico** (1). — JONES, T. H., in *Government of Porto Rico, Board of Commissioners of Agriculture, Bulletin* No. 12, 30 pp., 8 figs. San Juan, P. R., 1915.

The sugarcane stalk-borer moth (*Diatraea saccharalis* Fabr.), belonging to the *Pyralidae*, occurs in many tropical and subtropical regions, where it attacks not only sugarcane but also a large number of other Gramineae, amongst which maize is often seriously damaged. It occurs throughout the island of Porto Rico and causes serious damage in the cane plantations, and also to a less extent to maize, *Panicum barbinode* ("malojillo" or "Para grass") and *Hymenachne amplexicaulis*. Its eggs have also been found on *Oryza sativa*, while it may also live on other grasses.

The principal damage to surgarcane consists in the loss of saccharose due to the boring of the larvae in the stem. It also prevents the growth of the canes and detroys the buds ; in the case of young plants they bore the central buds, which become known as "dead hearts".

The eggs are deposited in groups on the leaves of the cane and hatch in about five days.

The insect passes its larval stage, which lasts 20 to 30 days, in the cane stalks, where it pupates, the adult emerging after 7 to 10 days.

In Porto Rico there are three natural enemies of this insect: a fungus (*Cordyceps barberi* Giard), attacking the larva and pupa; a Hymenopterous parasite of the eggs (*Trichogramma minutum* Riley, synonymous with *T. pretiosa* Riley), and a Tachinid (probably a new species of *Hypostena*) whose larva feeds on the borer larva, preventing it reaching the pupal stage. It is not improbable that there are also predatory enemies of the larvae and adults in the island.

As a preventive means immune varieties of cane are recommended. New plantations should be made and the harvest effected over large areas at once. The existence of old canes near fields of young canes facilitates infestation. The female is a poor flier and if the harvest is effected over large areas at the same time the probability of damage is reduced. Attention should also be paid to keeping the land free from other plants (Gramineae) acting as hosts.

Curative treatments consist in the collection of the egg-clusters and the cutting out of "dead hearts" to destroy the contained larvae.

Burning the vegetable matter on the fields after harvest is not recommended, since it does not ensure the complete destruction of the pest and entails the destruction of numbers of its natural enemies, especially those parasitic on the eggs.

The use of lamp-traps is also not advised, as more of the natural enemies are caught than of the pest itself. No cut stems should be left on the field after harvest.

(1) See also *B.* Aug. Sept.-Oct. 1911, No. 2567 ; *B.* Feb. 1913, No. 128 ; *B.* May 1913, No. 514 ; *B.* April 1914, No. 488. (*Ed.*)

1107 – **Observations on Some Coleoptera in Sugarcane Plantations.** — VAN DER GOOT, P., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXIII, Part 20, pp. 789-830, figs. Soerabaia, May 1915.

An enquiry was made on the distribution of beetles in cane plantations with the object of studying the parasites of these insects. The life-history of *Adoretus compressus* is described and the following parasites : 1) cryptogamic — *Metarrhizium anisopliae* and *Bacillus gigas* ; 2) dipterous — *Prosena siberita* and *Campylocera robusta*.

The most widely spread beetle is *Holotrichia helleri*, whilst *Apogonia destructor*, which ravaged the canes between 1890 and 1895, has almost disappeared except on certain plantations. On higher land *Lepidiota stigma*, *Leucopholis rorida* and *Anomala* (*Euchlora*) *viridis* may cause considerable damage.

A minute description is also given of the different species, with a table for identification.

1108 – ***Sipha flava* and *Aphis setariae* on Sugarcane in Porto Rico.** — JONES, T. H., in *Government of Porto Rico, Board of Commissioners of Agriculture, Bulletin* No. 11, 19 pp., 2 figs. San Juan, P. R., 1915.

Two species of aphis are known to be injurious to sugarcane in Porto Rico : *Sipha flava* Forbes (yellow sugarcane aphis), the more important, and *Aphis setariae* Thos. (brown sugarcane aphis), not common.

S. flava is known in the United States as a parasite on several grasses. At Porto Rico it also attacks sorghum and a species of *Andropogon* known as lemon-grass. *A. setariae* on the contrary is only known on sugarcane.

The yellow aphis lives on the lower surface of the leaves, especially on those beginning to bend over, whilst the brown aphis occurs at the junction of the sheath and leaf blade, on the under side and on both sides of the midrib.

In the field both species generally form colonies containing wingless individuals of various dimensions and some winged ones. Both insects are very small, the larger measuring about 2 mm. in length.

They are both accompanied by several ants for their honeydew. In the case of *S. flava* the presence of ants is more or less accidental, but there is a very strict relation between *A. setariae* and the ant *Solenopsis geminata* (fire ant or hormiga brava), which constructs earth shelters round the aphis colonies.

S. flava is attacked by the fungus *Acrostalagmus albus* Preuss., and by several predatory insects (*Cycloneda sanguinea* L., *Megilla innotata* Vauls., *Scymnus roseicollis* Muls., *S. loewii*, *Hyperaspis* sp., *Ocyptamus* n. sp. and *Chrysopa collaris* Schm.).

A. setariae is attacked by an internal parasite (probably *Lysiphlebus testaceipes* Cress.), by *Scymnus roseicollis* and by the larva of a Syrphid.

No artificial means of control are recommended for these aphids on account of the efficiency of their natural enemies and also on account of the difficulty and cost of application of satisfactory remedies.

1109 – **Ravages of Caterpillars on Intercrops in Java.** — DIETZ, P. A., in *Mededeelingen van het Deli Proefstation te Medan*, Year IX, Part 1, pp. 8-14. Medan, Sumatra, June 1915.

Insects attacking tobacco and other crops at Deli (Sumatra) include the following: *Heliothis*, *Plusia* and *Prodenia* on *Phaseolus mungo* ("katjang idjoe") and *Ipomoea batatas* ("obi tjina").

The latter plant is also badly attacked by the larvae of the convolvulus hawkmoth (*Protoparce convolvuli*) (1), which also attacks wild Convolvulaceae; the damage caused by these caterpillars depends upon the period of attack, the plant being more resistant after the formation of tubers. Mungo beans are also seriously damaged, but up to the present tobacco has remained free from attack; indeed in this case the hawkmoth larvae (hornworms) appear to offer protection by propagating the parasite *Trichogramma* (Hymenoptera), which also parasitises *Heliothis* (cutworms), which injure the tobacco plant.

1110 – **Further Occurrences of Cottonworm Moths (*Alabama argillacea*) on Strawberries in Minnesota** (2). — MOORE, WILLIAM, in *Science*, New Series, Vol. XLI, No. 1067, p. 864. Lancaster, Pa., June 11, 1915.

Alabama argillacea appeared during 1914 in several places in Minnesota. It was first recorded at Garden City (Blue Earth County) on September 21 and reported injurious to the fruits of perpetual strawberries. From October 10 to 15 other damage was reported on strawberries at Rochester, St. Paul and Excelsior on Lake Minnetonka, west of Minneapolis. The insect apparently remained a very short time in each of these localities. Damage was recorded again between Oct. 15 and 19 at Garden City, where great numbers of the moths reappeared after their almost complete disappearance in September.

(1) See also *B.* Oct. 1914, No. 973. (*Ed.*)
(2) See *B.* July, 1915, No. 774. (*Ed.*)

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